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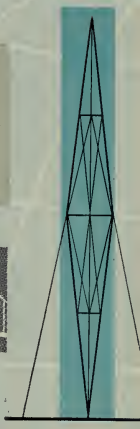

Careers in Engineering

1954-56 UNIVERSITY OF ILLINOIS BULLETIN

Requests for copies should be addressed to

W. L. Everitt, Dean
College of Engineering
University of Illinois
Urbana, Illinois

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1954-56

CAREERS IN ENGINEERING

An announcement of the College of Engineering at the University of Illinois, published by the University in Urbana

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OCT 5 1956
UNIVERSITY OF ILLINOIS

Prepared by the Committee on Careers in Engineering

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PART I
CAREERS IN ENGINEERING

I. CHOOSE YOUR CAREER CAREFULLY

You don't want to stumble into a job. You want to choose a career.

This booklet tries to help you do so. Most of it is for those of you who find yourselves drawn to engineering. But this first chapter will prove useful to everyone who is giving serious thought to his life's work, whether that turns out to be engineering, business, medicine, farming, law, or any one of a hundred occupations.

Selecting a career isn't a summer afternoon's task. But if you go at it systematically, you should end with a wise choice. Here is one approach that works for many people:

1. Make a list of the careers you're interested in.
2. Analyze yourself.
3. Analyze the careers you've listed.
4. Compare the results of each career analysis with your self-analysis, to see what fields of work seem to suit you.
5. From among the careers left on your list, choose the one that interests you the most.

When you take the first of these steps — listing careers — forget everything except what appeals to you. However, if you have put down only three or four fields of work, check other careers that you now know little about. You will find additional interests. Add these to your list.

Then analyze yourself. List the things you like and the things you dislike. List your physical skills and handicaps. Look squarely into your mind, and list what it can do well and what it does poorly. In short, try to see yourself as you really are.

Most of us find it hard to size ourselves up this honestly. So, to do the job for us, there are available several kinds of testing and guidance groups. Some are commercial. Some are in high schools. Another is the University of Illinois Student Counseling Bureau; it operates at both the Urbana-Champaign campus and the Chicago Undergraduate Division (Navy Pier). You can use this Bureau without charge if you plan to attend the University of Illinois.

Now for the third part of your job — analyzing the careers that seem desirable in view of what you yourself are like. Make this analysis in whatever way the sources of information that you can use will allow.

The University of Illinois Library

You may want to start by using your public library, which contains material on many careers. Or you may want to postpone library study till after you have talked to men and women who hold the kinds of jobs you're interested in. Most of these people will be glad to tell you what they do and how they were trained. You will probably arrange to visit industrial plants, construction jobs, business offices, and testing or research laboratories. You can get further facts from universities, colleges, and professional and trade organizations.

Of course, weigh what you are told. You may meet up with prejudice. Any book or man or group that says to forget about a given field because it is overcrowded or to enter it because of its "outstanding opportunities" may be biased. Crowdedness or opportunities can change quickly. What's more, if your self-analysis shows that you have a good mind, you can succeed, no matter how stiff the competition may be.

What data should you gather? Here is a list that you can adapt to suit your own purposes:

1. Types of jobs available in the field. In general, each main career — engineering, law, journalism, agriculture, and so on — can be analyzed into jobs by the use of one or more of the systems of classification given on pages 16-30.

2. Education requirements — especially the mental and manual skills demanded by the career and by the jobs within it.

3. The personality of successful men and women in the career you're studying. Like your own personality, this is hard to get at. But try, because a knowledge of this factor helps to show whether you are likely to be happy in a particular career or job.

4. Type of industries and organizations offering employment.

5. Number of people in the career or any main job within it. This figure gives a rough idea of the amount of competition you can expect. Obtain information that's up to the minute. In fact, seek forecasts covering the first few years after you go on the job; but remember that no predictions can be counted on absolutely.

6. Social prestige of the career or job. This is to be considered, but don't let it weigh too heavily.

7. Pay — average salaries, and also lowest and highest. Take into account that total pay includes more than cash pay. It even includes such intangibles as personal satisfaction.

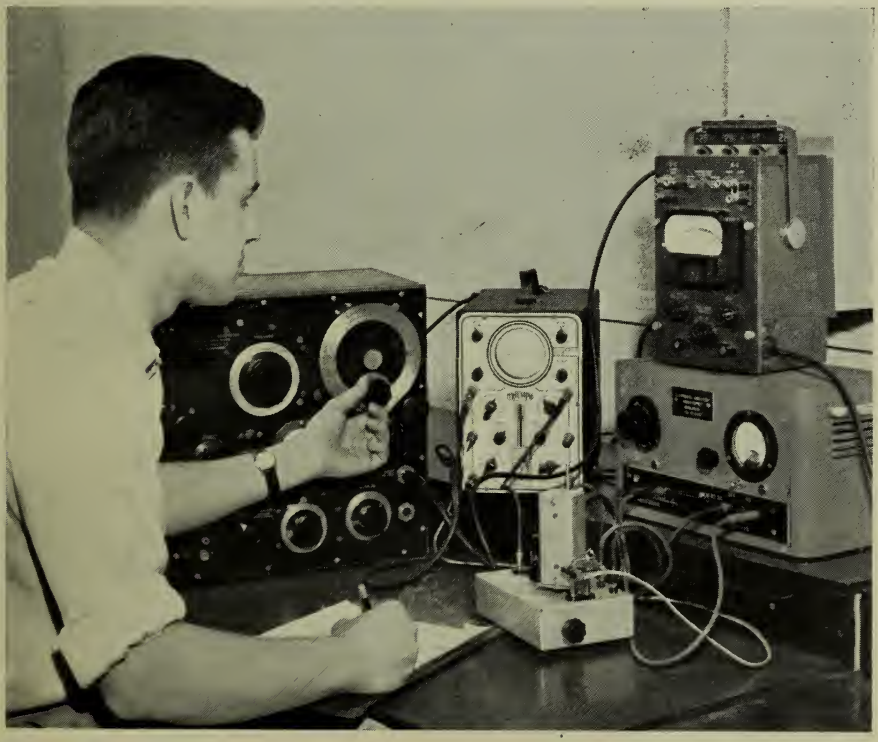
Next compare the analysis of each career or job with the analysis of yourself.

The first result of this comparison may be a feeling that no one career suits you exactly. Along with this may come the feeling that any one of three or four careers comes close to fitting you. Regard these reactions

as normal. They shouldn't discourage you. They should simply lead you to analyze the career, and yourself, more fully.

Then take time to decide. Don't rush. However, it is wise to do your self-analysis no later than the end of your sophomore year in high school. The freshman year is even better. Here is the reason: Most engineering colleges require a great deal of high school mathematics. So, if you think you might want to become an engineer, you should try as early as the ninth grade to size up yourself and your prospects and should choose your high school subjects accordingly.

Many students ask, "Should I go a step further? Should I decide, before I enter college, what particular branch of engineering (or law or journalism or medicine or business) I want to go into?" The answer is no. While it may help to settle this question early, you don't have to. Most college courses are not highly specialized until the junior year. This means that you can wait until you get into college before you choose a specialty within your major field of work.



An experiment in the Radio Engineering laboratory

II. WHAT YOU NEED TO KNOW ABOUT ENGINEERING

WHAT IS ENGINEERING?

You can find a dozen definitions of engineering. Here's a very common one: *Engineering is the art and science by which the properties of nature and the sources of power in nature are made useful to men.*

An engineer, then, is a creative professional man specifically trained and experienced in the use of materials, men, and money so that these forces are put to the service of mankind.

You sometimes hear technicians, craftsmen, artisans, or skilled operators of equipment called engineers. Now, the careers these men follow are important to society. But they're not engineering in the professional sense. Professional men — engineers among them — are largely guided by an unwritten code of ethics. This code has been built up by tradition over hundreds of years. Its basic principle is that the professional man must be honest with his superiors, his colleagues, his subordinates and, above all, himself.

Why do people sometimes get confused in answering the question, "What is an engineer?" Because most engineering projects require the services of three groups of workers: (1) professional engineers, (2) technicians, and (3) skilled artisans. To clear up the confusion, study the definition of a professional employee used in the Taft-Hartley Bill, title I, section 101, sub-section 2, paragraph 12:

The term Professional Employee means

(a) an employee engaged in work

(i) predominantly intellectual and varied in character as opposed to routine mental, manual, mechanical, or physical work;

(ii) involving the consistent exercise of discretion and judgment in its performance;

(iii) of such character that the output produced or the result accomplished can not be standardized in relation to a given period of time;

(iv) requiring knowledge of an advanced type in a field of science or learning customarily acquired by a prolonged course of specialized intellectual instruction and study in an institution of higher learning or a hospital, as distinguished from a general academic education or from an apprenticeship or from training in the performance of routine mental, manual, or physical processes; or

(b) any employee, who
  (i) has completed the courses of specialized intellectual instruction and study described in clause (iv) of paragraph (a), and
  (ii) is performing related work under the supervision of a professional person to qualify himself to become a professional employee as defined in paragraph (a).

The work of the technician often involves repetitive tasks, the basic theory of which he need not fully understand. The engineer on the other hand must have a knowledge grounded in basic sciences, must exercise initiative and judgment, and bears responsibility in law for his performance.

Just as often, people get confused about the relation between engineers and scientists. Let's see if we can set the matter straight.

Science consists of systematized knowledge of the facts and laws of the physical or material world. Men and women who work professionally with such knowledge are usually called scientists or engineers.

The *research scientist* uses existing knowledge in order to gain new knowledge of the material world. He is the man who is commonly referred to as a scientist. Knowledge of the physical world is now so extensive that any one research scientist usually restricts himself to one field, such as physics or chemistry.

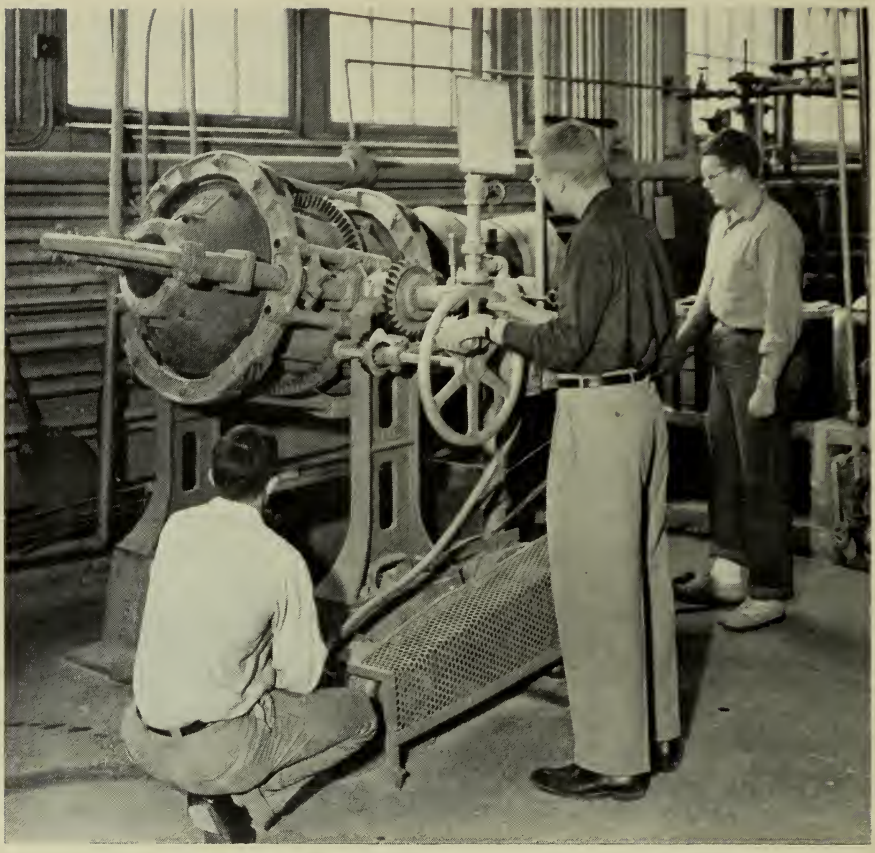
The *engineer* is a scientist who uses existing knowledge of the material world for the direct benefit of mankind. He must have imagination so that he can recognize practical values in the discoveries made through research. Then he must have the skill to turn these values into concrete achievements. When the engineer is directly developing new ways of applying the known laws of nature, he is doing *engineering research.*

Engineers and research scientists work cooperatively to benefit mankind. The linkage between the activity of these two types of scientists is so close and strong that we often find it hard to say, "This man is a scientist, whereas that man is an engineer."

THE "ENGINEERING METHOD"

No set of brief definitions can give a full enough picture of what engineering is. The only way to get this broader view is to know how the engineer works. The point is this — the engineer does not merely make the properties of nature useful to man; he does so in a particular way. The method he uses to solve a problem consists of many steps.

Suppose you're an engineer. You've been given, or you've run across, a specific problem that must be solved. What do you do?



The rotary smelter used for melting large batches of enamels or glazes — shown operating the smelter are seniors in Ceramic Engineering

First, you study the nature and extent of the problem. You pay special attention to the practical action that will result from your solution.

Next you analyze the problem into its parts. Some of these parts, in turn, will consist of technical problems. Others may consist of problems of dealing with people. Always the financial angle — the cost — will have to be taken into account.

Next you spend a lot of time and thought in trying to determine all of the relationships among the parts into which you have broken the over-all problem. For example, in a heating project you may find that what the average householder wants and what he can afford to buy are

two different things, and you may have to decide whether a compromise is possible, profitable, and safe.

In other words, you go beyond listing relationships; you evaluate the factors involved in each part of the over-all problem. You weigh each factor according to its importance, and you discard all factors that you think will not affect the practical solution. After that, you gather all further information you need about the remaining factors. Throughout this stage, you use all the knowledge you have gained or can gain from experience, observation, discussion, reading, experiment, and research.

Now you obtain a solution for each of the parts of your original problem.

The next thing you do is to bring these partial solutions together and see if they add up to a solution for the total problem you started with.

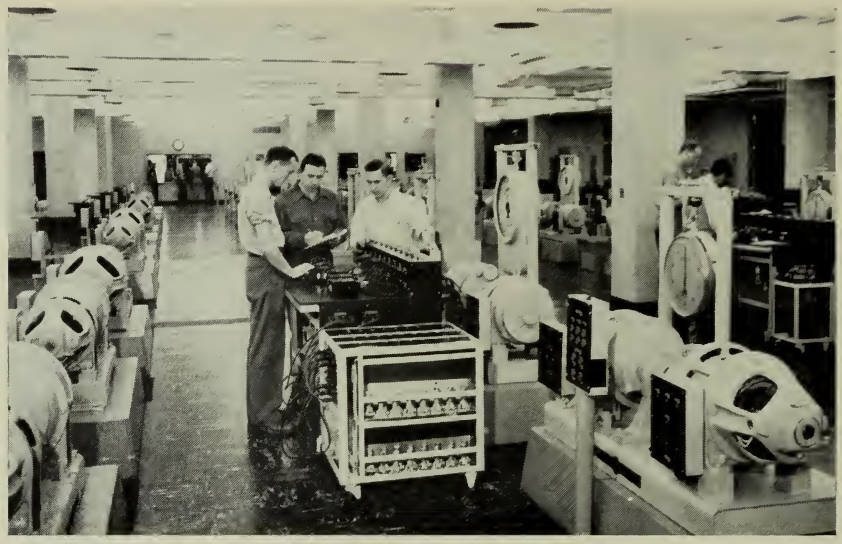
But you realize that you're not through. If time permits, you re-examine the problem to find a still better solution. Many problems in engineering involve data that you can not get in precise quantitative form within the time you have available. So you frequently can not obtain a unique answer like that which many purely mathematical problems give. There may be several possible solutions. You must use your keenest judgment in choosing the one which seems best in view of all the circumstances and all the factors.

It is clear that the engineer not only thinks analytically. In addition, he works systematically. It is his organized attack on a problem, together with his mental integrity, which is his outstanding trait.

WHAT KIND OF PERSON IS AN ENGINEER?

Whenever you try to list the personal characteristics needed in engineering, you meet the problem: What is a "typical" or "average" engineer? Some guidance organizations will give you tests to determine your "personality profile" and will compare it to that of an "average engineer." The trouble is that there is no average engineer. As you will see from the classifications of engineering jobs (pages 16-30), two engineers may be performing duties which can no more be compared to each other than surgery can be compared to farming.

Though there is no average engineer, yet the engineer must share with successful men in any profession such characteristics as these — a willingness to work hard; the capacity to assume leadership; the ability to cooperate with others; the hardihood to persist and endure; and an abiding honesty in thought when dealing with facts and in action when dealing with men.



The Electrical Machinery laboratory can accommodate ten classes at a time

Investigation on one of the new types of residential heating systems

Besides these general character traits, he must possess at least half a dozen more specific ones:

1. A curiosity about and an interest in natural phenomena.
2. The ability to think logically.
3. A positive interest in mathematical analysis.
4. The ability to set up mental pictures.
5. The skill necessary to create ideas and to devise ingenious equipment.
6. The ability to weigh ideas and make wise decisions, often when the data are incomplete — in other words, good judgment.

This doesn't mean that every good engineer has to possess every one of these traits in great measure. And it certainly doesn't mean that he needs to possess no others. But it does give a general idea of what you need for success in most engineering work.

THE CREED OF THE ENGINEER

Even at the risk of undue repetition, let us stress again the high ethical standards that the engineer sets for himself. They are summed up, better than we can state them, in the Faith of the Engineer, the official creed of the profession as set forth by the Engineers' Council for Professional Development:

I AM AN ENGINEER. In my profession I take deep pride, but without vainglory; to it I owe solemn obligations that I am eager to fulfill.

As an engineer, I will participate in none but honest enterprise. To him who has engaged my services, as employer or client, I will give the utmost of performance and fidelity.

When needed, my skill and knowledge shall be given without reservation for the public good. From special capacity springs the obligation to use it well in the service of humanity; and I accept the challenge that this implies.

Jealous of the high repute of my calling, I will strive to protect the interests and good name of any engineer that I know to be deserving; but I will not shrink, should duty dictate, from disclosing the truth regarding anyone who, by unscrupulous act, has shown himself unworthy of the profession.

Since the Age of Stone, human progress has been conditioned by the genius of my professional forebears. By them have been rendered usable to mankind Nature's vast resources of material and energy. By them have been vitalized and turned to practical account the principles of science and the revelations of technology. Except for this

heritage of accumulated experience, my efforts would be feeble. I dedicate myself to the dissemination of engineering knowledge, and especially to the instruction of younger members of my profession in all its arts and traditions.

To my fellows I pledge, in the same measure I ask of them, integrity and fair dealing, tolerance and respect, and devotion to the standards and the dignity of our profession; with the consciousness, always, that our special experience carries with it the obligation to serve humanity with complete sincerity.

KINDS OF ENGINEERING JOBS

As you have seen, success in the engineering profession requires not only that you have certain personal characteristics which are common to all members of the profession but also that you either have or develop additional traits which will be determined by the nature of the job you enter. This brings us to the problem of classifying and describing various types of engineering jobs. To give you an idea of the relationship among the engineering jobs, our presentation consists of three related methods of classification:

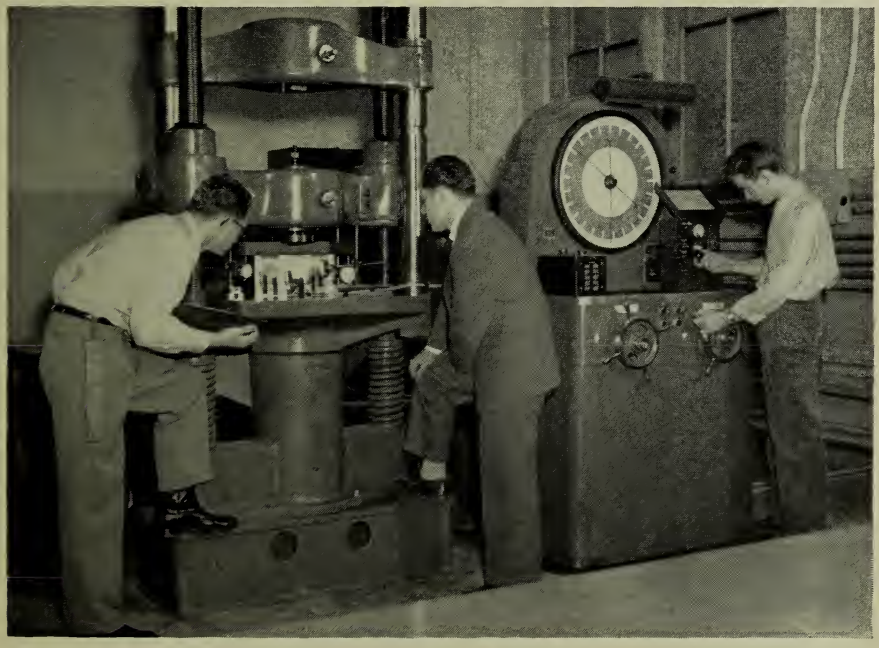
1. According to the main branches which are recognized in industry: aeronautical, agricultural, architectural, ceramic, chemical, civil, electrical, engineering physics, general engineering, industrial, mechanical, metallurgical, mining, petroleum.
2. On the basis of the functions of the various jobs performed by engineers regardless of what branch they're in: operating, construction, service, sales, application, test, production, design, development, research.
3. On the basis of the degrees of responsibility which can be associated with most of the jobs classified by the first two methods: engineer in training, technical, supervisory, administrative.

THE MAIN BRANCHES OF ENGINEERING

Engineering once dealt only with the construction of roads, bridges, forts, and other structures for military purposes. Later, as the need for such installations for nonmilitary uses became evident, a large group of engineers separated from the military to become "civil" engineers. After this, other groups of engineers split off into new branches, as scientific and technical knowledge grew beyond the capacity of any one man to master. In recent years the amount of accumulated technical knowledge has become so great that individual engineers may specialize in even more concentrated areas of knowledge than are represented by the main

branches. These subdivisions are listed in the section on curricula (see pages 89-122) as "options." However, the brief descriptions that follow — some of which are based on the list of accredited curricula in the Fifteenth Annual Report of the Engineers' Council for Professional Development — concern only the main branches.

1. *Aeronautical Engineering* involves primarily the application of scientific and engineering principles to the development and design of airframes and aircraft power plants. In a very general sense, the field may be subdivided into aerodynamics, structures, propulsion, and design. The complexity of aerodynamic and structural problems, which many times can not be solved by mathematical methods alone, frequently necessitates experimental investigations. Consequently some aeronautical engineers engage in the design and development of equipment for experimental research; and, of course, many are concerned with its operation and the analysis of data obtained through its use. The best proof of any aircraft design comes from the analysis of full-scale flight tests; consequently many flight research groups are staffed with aeronautical engineers. The operation of transport and cargo aircraft is another scientific problem requiring the services of aeronautical engineers. In



Compression test of a stiffened panel in the Aircraft Structures laboratory

A demonstration of terracing for soil and water conservation

The modern laboratories for Chemical Engineering

addition to investigating operational problems and handling engineering maintenance, the aeronautical engineer proposes modifications to existing aircraft so that those designed in the future will perform with increased efficiency and safety. He is responsible for solving all technical problems encountered in designing aircraft ranging from the smallest personal airplane to the largest transport, from the slowest liaison craft to the supersonic airplane and missile, and from the present-day helicopter to the less conventional roadable aircraft and convertaplanes of the near future.

2. *Agricultural Engineering* deals with the solution of problems in the application of mechanical, electrical, and civil engineering to the farm. Such problems concern the design, development, and maintenance of (1) gasoline-, diesel-, and electrically-powered farm machinery and farm implements, (2) farm buildings, including their arrangement for efficient operation and such functional requirements as lighting, heating, ventilation, and distribution of feeds and refuse, (3) equipment for crop processing and handling, such as grain and hay driers, feed grinders and distributors, and (4) such physical improvements as drainage, soil erosion control, flood control, land clearing, and irrigation. The agricultural engineer in industry or in public works, with technical training in one or more of these special lines, is well prepared to bring his knowledge of engineering and agriculture to the solution of these farm problems.

3. *Ceramic Engineering* concerns the scientific principles and engineering involved in the production and utilization of nonmetallic minerals. Emphasis is placed upon the processes and products of manufacture in such industries as glass, porcelain enamels, structural clay products, refractory materials, metal ceramics, whitewares, pottery, abrasives, and cements. The ceramic engineer also deals with the layout and design of plants, machinery, and equipment, and their use in the manufacture of ceramic products. He takes basic courses common to other engineers and technologists. The development of new processes and products and the application of materials constitute an important part of his work.

4. *Chemical Engineering* involves the development and application of manufacturing processes by which raw materials are changed in chemical composition and physical form to products for industrial and commercial use. The processes by which the physical changes are brought about may be classified into a series of "unit operations" for which the principles are the same in all industries. Chemical engineers are concerned with the control of chemical reactions during the processing to produce the desired product in the most economical way. Some of the industries in which these engineers are employed are oil refining, pulp and paper,

plastics, atomic energy, and the manufacture of organic chemicals, heavy chemicals, synthetic fibers, rubber, fertilizers, and pharmaceutical chemicals.

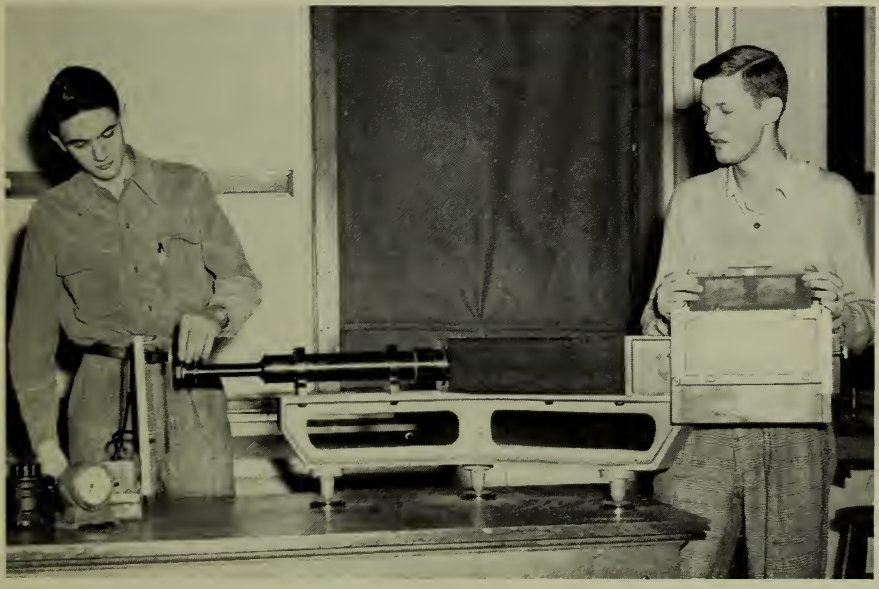
5. *Civil Engineering* is, as was mentioned previously, the oldest of the several branches. In addition the scope of civil engineering is one of the broadest. Traditionally dealing with the construction of roads, bridges, railroads, harbors, and canals, the work of the civil engineer also includes the development, design, and construction of buildings, airfields, dams, tunnels, and water and sewerage systems. In the performance of his work the civil engineer has to cope with all sorts of physical conditions, devise ingenious ways of solving engineering problems, develop new construction materials, and create new machinery to build some of the structures he designs.

6. *Electrical Engineering* concerns both the problems of the generation, transmission, and utilization of electrical energy and of the communication of information from place to place or person to person. Thus, the problems faced by the electrical engineer range from the design, manufacture, and operation of great generators in our power stations, to those involved in the research underlying tiny hearing-aid vacuum tubes, radar devices, and computers which rival the human brain. Dealing with such a varied field, the electrical engineer finds ample opportunity to follow any type of work, whether it be sales, manufacturing, design, development, or research.

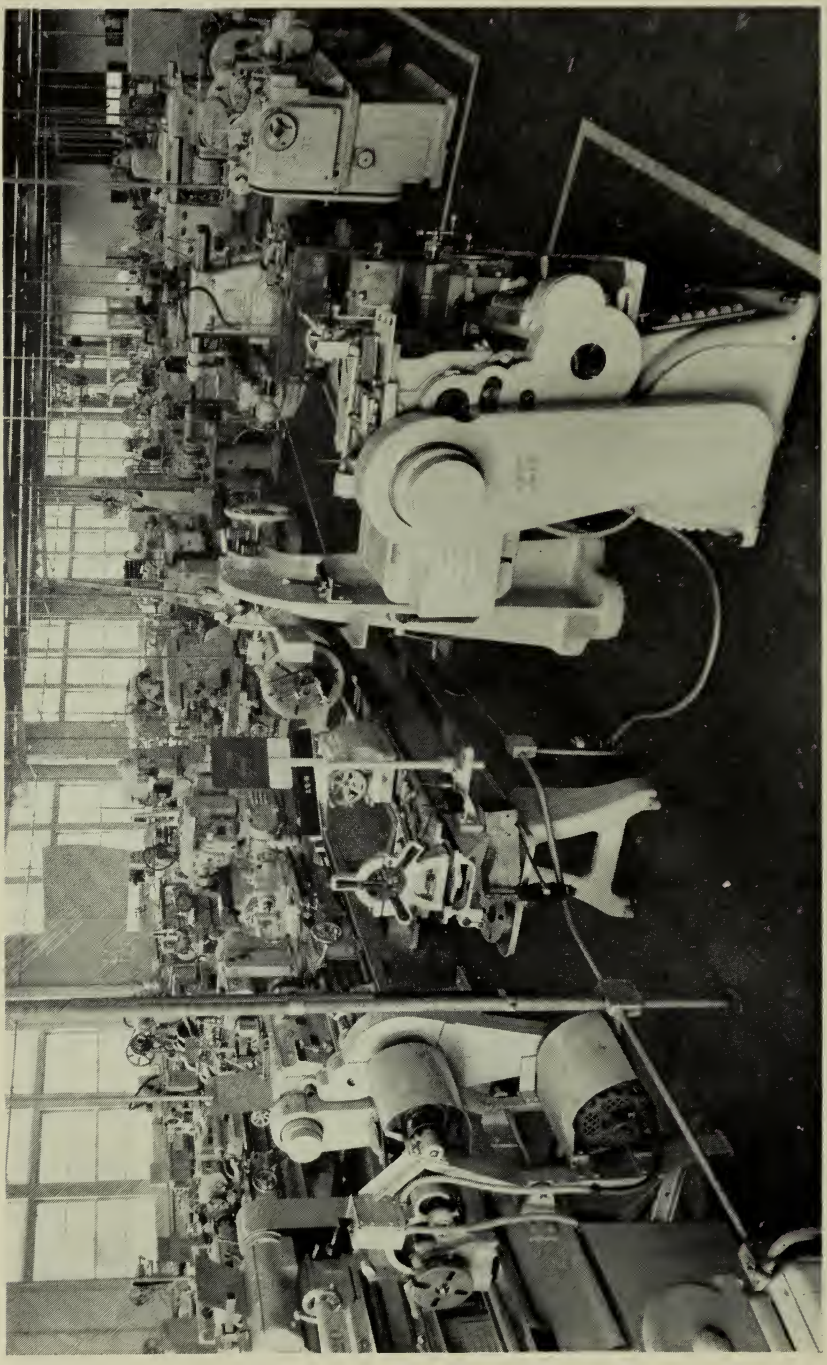
7. *Engineering Physics,* though not yet generally recognized in industry as a branch of engineering, is beginning to assume importance because of the recent developments in atomic energy. The physicist concerns himself primarily with research into physical phenomena and the laws governing them; the engineering physicist tackles the problem of utilizing these phenomena in industrial processes. He actually works in many of the branches listed here, just as the physicist does at the level of pure research. In the development of atomic energy, the engineering physicist worked right along with the physicist and the chemist in the design and development of manufacturing plants and equipment required for the process of nuclear fission.

8. *General Engineering* offers a sound education in basic engineering sciences for those who do not wish to specialize in any of the other major fields of engineering. A flexible choice of electives permits the general engineer to prepare for a career in engineering business, engineering sales, engineering geology, technical journalism, or teaching of technical subjects. By securing additional legal training he can specialize in engineering law or pursue a career somewhat outside the beaten paths within the traditional engineering fields.

Scale model study in Hydraulic Engineering laboratory to determine most effective remedial measures for bridge erosion problems



An experiment in the Physics Optics laboratory

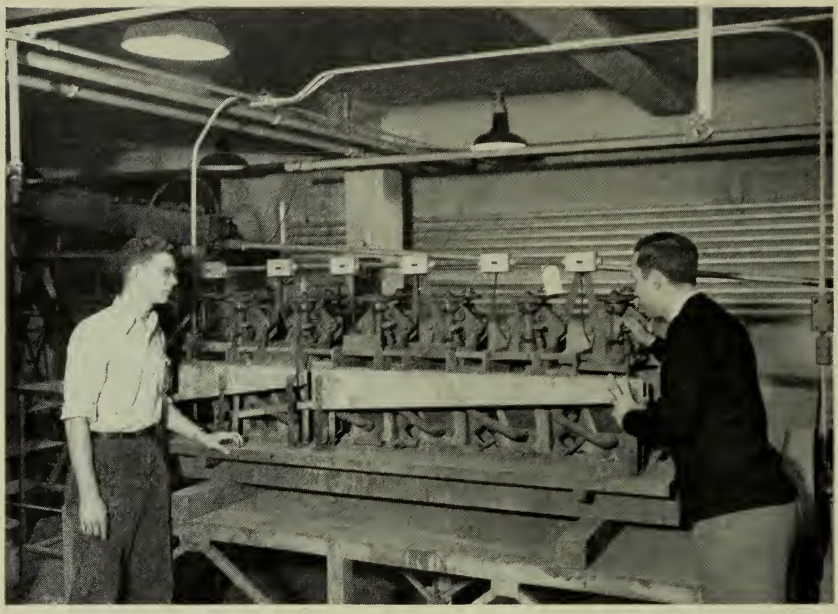


The Metal Processing laboratory

9. *Industrial Engineering* is concerned essentially with the cost and production of goods according to a strict schedule, while other branches of engineering are concerned primarily with the function and quality of a product. It is a science of planning for manufacturing in the same way that the older branches of engineering are essentially a science of planning a design. It is concerned with coordinating men, materials, machines, and money to the end that a product of the quality specified by the designer can be produced at a minimum cost, and at a time desired by the consumer. It involves planning the organization, analyzing the product design in terms of manufacturing procedures, selecting machinery, designing special tooling, determining the plant layout and materials handling methods, establishing the work methods and output standards, studying wage payment systems, and setting up methods of quality control. Industrial engineering has an application in any field of manufacturing, regardless of whether the product is metal, cloth, paper, or plastics. Because modern industry is highly mechanized, the industrial engineer must be essentially a mechanical engineer with background in management, economics, and accounting. Since the human element is a major factor affecting his plans, it is also desirable for him to have a good background in personnel management, psychology, and sociology.

10. *Mechanical Engineering* deals with the generation and transmission of power and the design, construction, operation, and testing of all kinds of machinery. Like the civil and electrical engineer, the mechanical engineer performs a great variety of jobs. In the transportation field alone he works with marine, railway, automotive, and aircraft equipment. In addition he works with equipment ranging from machine tools, engines, and turbines to refrigerators, air conditioners, and heating and ventilating plants.

11. *Metallurgical Engineering* is primarily distinguished from other fields by its emphasis on materials rather than on machines and structures. A metallurgist, then, has a basic interest in the design, processing, and testing of engineering materials. The metallurgical field can be divided into three broad divisions: extractive metallurgy, dealing with the separation and purification of metals from their natural states; mechanical metallurgy, treating of the shaping and fabrication of metals into useful parts for industry; and physical metallurgy, involving the nature, structure, treatment, and properties of metals and alloys. The metallurgical engineer's job is to analyze all applications of metals, and provide the proper metal processed in the proper manner to obtain the best performance possible. Thus, the metallurgist is essential to all industries producing metal products or using metals in their processes of manufacturing.



Flotation cells used in mineral dressing

12. *Mining Engineering* is concerned with the removal of valuable minerals from the earth's crust as a profitable enterprise, and also with the production of the maximum amount of useful minerals from our available mineral deposits. Classes of deposits mined include those which contain metallic minerals and those which contain nonmetallic minerals. Some are mined by surface methods, but most are taken from the earth by underground methods of mining. The mining engineer plays an important role in supervising the prospecting, exploration, development, and exploitation of all types of mineral deposits. His work includes the design, surveying and map work, operation, safety, and ventilation of mines, and an active participation in all the other divisions of mining and its related industries. A few mining engineers find employment in more specialized fields: machinery design, sales, teaching, and research.

Petroleum is also considered to be a mineral and many operations are common to both the mining and petroleum industries. This relationship makes it possible for mining engineers to find employment very readily in the petroleum production industry.

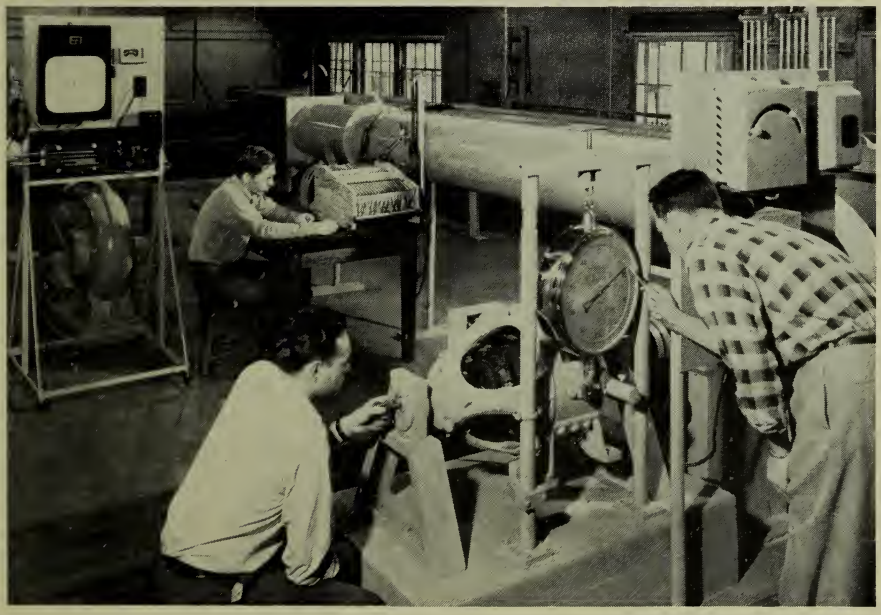
13. *Sanitary Engineering* is confined to the design, construction, operation, maintenance, and administration of structures, equipment, and

organizations for the purpose of protecting and improving the public health and comfort. Most common among sanitary engineering activities are the procurement, purification, pumping, and distribution of water supplies; the collection and disposal of liquid and solid wastes; the prevention of stream pollution; and public health work to prevent the spread of disease through physical control of the environment. The sanitary engineer is primarily a civil engineer with special knowledge of chemical and biological sciences. He must be prepared to meet and work with the public in order to point the way toward better health and greater comfort.

Other branches of engineering are recognized, and in certain parts of the United States they have attained much industrial importance. Examples are geological engineering, petroleum engineering, and textile engineering. Throughout this country, architectural engineering plays a considerable role.

ENGINEERING WORK CLASSIFIED BY FUNCTION

The descriptions of each of the main branches in the preceding list give only a general idea of the types of work engineers perform. A few typical functions have been listed for each branch, but you should understand that one man is not called on to perform all of these functions.



Testing a ventilation system in the Mining Engineering laboratory

As a matter of fact, any particular engineering job will probably consist of only one or two of these functions. In the course of your career, however, you will undoubtedly perform several of them as you change jobs. The following list includes a more complete description of functions performed by engineers. Again, understand that not all of the main branches contain every one of the job functions listed here.

Work done by engineers outside what are usually thought of as engineering and industrial fields is not listed below — such work as teaching, technical journalism, and the like.

The sequence in which the functions are listed is based, not on the importance of the functions, but rather on the order in which a new discovery is handled until it has been made useful to man.

1. *Research Engineer.* The research engineer's energies are devoted to extending the horizons of knowledge. He must search and study the literature on a particular subject, make calculations to verify theory, and conduct experiments to prove, reject, or modify existing theories. A man engaged in *scientific* research investigates physical laws for the purpose of increasing scientific knowledge, without being particularly concerned about the immediate application of his discoveries. In *engineering* research the aim is to solve specific manufacturing problems, to develop new equipment and materials for which there is a need, and to evaluate theoretical relationships in terms of the actual behavior of materials and engineering structures.

2. *Development Engineer.* The development engineer's function is mainly to take the results and discoveries of research and develop them into useful apparatus, products, or methods. He needs to do a considerable amount of experimental and analytical work in order to get a product or method into final form for production or use.

3. *Design Engineer.* The design engineer is responsible for preparing detailed plans and specifications from which a piece of apparatus is produced or a project is constructed. He makes the necessary calculations and sketches, writes detailed specifications or else supervises the writing, selects needed materials and processes, helps prepare the specifications for test procedure, and establishes acceptable performance standards for the manufacture of equipment or the fabrication of structures. To do this he must be analytically inclined and be able to visualize what happens during the operation of any piece of equipment. He must also keep up to date on the latest developments and on the patent situation in his field.

4. *Production Engineer.* The production engineer is responsible for the manufacture of products and apparatus from raw materials and designs. He analyzes the methods, processes, and equipment used in the

manufacturing operation. Giving due consideration to economic factors, he works closely with the design engineer on manufacturing problems. In addition to having a good knowledge of engineering and manufacturing procedures, he must also be informed about the principles of industrial management and the problems of human relations that go with it.

5. *Test Engineer.* A test engineer performs different functions, depending on the branch of engineering in which he is employed. In some cases he is in direct charge of the actual testing of equipment, materials, and processes, to find out whether they meet specifications and accepted engineering standards. In the cases where the test engineer is associated with the research or development phases of the organization, he is responsible for setting up the test facilities and conducting the tests so that he can verify or disprove the facts to be determined from the tests. The results of calculations from the test data will then provide information from which further modifications or improvements can be made. This type of engineering requires frequent contact with engineers of the research and design groups.

6. *Planning Engineer.* The planning engineer solves plant and system problems. His job involves the selection and combination of equipment or facilities which are best suited to accomplish a required task. To do this, the facilities must meet certain technical standards, provide the proper capacity for the volume of operations involved, and produce satisfactory results at the most reasonable cost. In a manufacturing company the planning engineer, or application engineer as he is sometimes called, also acts as a consultant to the sales organization and helps select the specialized equipment that will best serve the customers' needs. The planning engineer must have a good engineering background, the ability to visualize all aspects of a problem, a well-developed economic sense, and an unusual amount of imagination in order to anticipate developments and needs of the future.

7. *Sales Engineer.* The sales engineer works directly with the customer as the manufacturer's sales and engineering representative. As in any sales work, he will need to study customers' needs. He will also need to know thoroughly the equipment he is selling, so that he can explain its design, construction, and operating features to the customer. Ordinarily he will be responsible for arranging the delivery date of the equipment and occasionally for negotiating its sales price. In addition to technical training, he will need the type of personality that inspires confidence, and the ability to work with people.

8. *Service Engineer.* Men who decide to work as service engineers supervise the installation of new apparatus and perform the final tests. They investigate customer complaints and correct any trouble which the

equipment may be giving the customer. In many cases the difficulties may be important enough to require that they restore operations as soon as possible — often under emergency conditions. Since the work covers a broad field in widely varying situations, these men need a good, broad engineering knowledge along with plenty of ingenuity. Because service engineering necessitates dealing with the customer, many companies combine service and sales engineering into a single job.

9. *Construction Engineer.* The construction engineer supervises the construction of facilities and structures from designs and plans, a job which calls for ingenuity in the practical application of physical principles. This work requires familiarity not only with the technical problems as they apply to a particular field but also with the problems specifically associated with all construction work — namely, the procurement of materials, the selection and proper use of equipment, and the handling of men. The ability to work with others and direct their efforts is as important to the construction engineer as is his technical background.

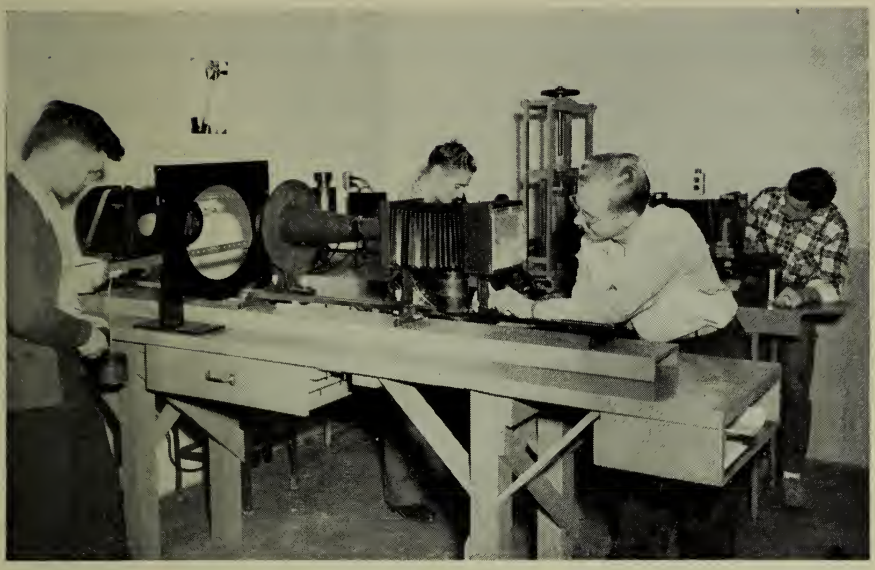
10. *Operating Engineer.* The operating engineer is charged with the responsibility of operating part or all of an enterprise safely, efficiently, and without interruption. He may work with a group of machines, a plant, or a system. In many companies, he supervises procurement of supplies and repair parts, protection and maintenance of equipment, selection of new equipment, and direction of operating personnel. In case of a breakdown or an emergency he must have the ingenuity and resourcefulness to restore full operation, frequently under the most difficult conditions. Like the construction engineer he must have a broad engineering background and be able to handle men. He should not be confused with those who perform repetitive tasks in the operation of existing equipment. Such men are not engineers in the professional sense.

ENGINEERING WORK CLASSIFIED BY LEVEL OF RESPONSIBILITY

The third and final way of classifying engineering jobs is based on the amount of responsibility required for the job. Again, not every one of the following levels exists for each of the functions just classified.

1. *Work as Engineer-in-Training.* Many young engineers are first classified as trainees. Under the close direction of the organization employing them, they continue their education but focus it sharply upon the demands and procedures of the industry and organization to which they now belong.

2. *Technical Work.* The first type of job a young engineer encounters consists of work at the technical level and demands a minimum



Stresses are determined in transparent models of irregularly shaped members by means of polarized light

of responsibility on his part. He solves technical problems under the general supervision of someone else who determines what problem is to be attacked and when a satisfactory solution has been reached.

3. *Supervisory Work.* The next type of job, which the engineer can attain only after having proven his ability, consists of work at the supervisory level. He assigns problems to other engineers and directs their work. In this capacity he is responsible for the proper operation of a group or a department in an organization.

4. *Administrative Work.* The maximum amount of responsibility the engineer can assume, provided he has superior ability and experience, consists of work at the administrative level. In such a capacity, he is concerned with the broad aspects of the operation of his company, including general policy, organization and coordination, personnel, finance, law, and public relations. Many engineers hold administrative positions, especially in engineering industries.

On his first job the young graduate is usually known as a junior engineer. Later, when he engages in supervisory work, he may bear any one of such titles as these — assistant chief engineer, resident engineer, supervising engineer. Men on the administrative level are known as managing engineers, chief engineers, and the like.

For any of the levels of work and responsibility described above, a college degree from a reputable institution is almost indispensable.

EMPLOYMENT OF ENGINEERS

Graduates of engineering colleges are employed in many diverse positions and organizations. Because of the broad and fundamental character of the training which they receive in accredited colleges of engineering and through their regular work periods in industry and engineering offices during the summer and other college vacations, they quickly adapt themselves after graduation to the vocational needs of their positions. A major fraction of the graduates ultimately attain positions of responsibility and trust in industry, government, and business.

The most attractive positions for graduate engineers who aspire to high professional status in the fullest meaning of the term are, of course, in engineering organizations which render professional and management services to industry, business, and the public in general. Furthermore, large industrial concerns maintain complete engineering offices within their own organizational setups which offer the graduate fine opportunities for professional growth and advancement. Manufacturing and the construction of engineering works require many graduates of varying degrees of training and experience.

Equally high professional status is acquired by the engineer in the employ of governmental agencies at the national, state, and city levels. Outstanding in these areas, from the technical point of view, are the Bureau of Reclamation, the Bureau of Standards, the Army Corps of Engineers, state highway departments, city engineers' offices, and many government research and developmental agencies, as well as technical control boards and commissions operating under governmental authority.

More and more, qualified engineers are finding employment in sales and service positions in industrial concerns manufacturing highly specialized and complicated products, primarily because of the technical problems involved in the installation and operation of such equipment.

WOMEN IN ENGINEERING

There are excellent opportunities for women in the engineering profession. Many women have become outstanding in their particular fields of interest. Over the past several years there has been a steady increase in the ratio of women to men students enrolled in engineering curricula in colleges and universities. Girls who have done well in such high school subjects as mathematics, chemistry, and physics should seriously consider the possibilities of engineering careers.

THE KIND OF EDUCATION NEEDED BY THE ENGINEER

Since engineering is a mental occupation — though it requires certain manual aptitudes and skills — the education of engineers is aimed mainly at developing mental ability. This goal is not reached overnight; as a matter of fact, the real educational process never ceases. In general, engineers gain their formal education on three distinct levels: (1) high school, (2) college or university, and (3) post-university industrial organizations.

At the high school or "pre-engineering" level you should begin to think about whether you want to aim toward the engineering profession. For this reason it has been recommended (page 7) that you perform a preliminary analysis of yourself while you are still in high school. To get a good foundation for more advanced work at the college level, in your high school studies you should achieve the following:

1. A complete mastery of the principles of arithmetic, algebra, plane and solid geometry, and trigonometry.
2. A thorough understanding of physics and chemistry.
3. A good background in English.
4. Some knowledge of government, so that you understand better the society in which you live.
5. Superior ability to study efficiently.

Unfortunately too many high school students are coming to college with a deficient background in English, mathematics, physics, or chemistry. Large numbers of prospective engineering students are graduating from high school with too great a percentage of their courses in shop work and too little training in these basic subjects and in the social sciences. The person who suffers from this deficiency or is a poor student will have trouble in meeting the scholastic standards of a university or college.

As is explained more fully later (pages 72-73), the regular four-year curriculum of the University of Illinois College of Engineering will begin with analytic geometry. The several ways in which this requirement can be met by entering students are set forth in a bulletin, *Mathematical Needs of Prospective Students,* requests for which may be made to the Dean of the College of Engineering. Of special importance in this bulletin is the section listing somewhat more than one hundred indispensable mathematical concepts and skills.

The second or college level of an engineering education is that with which you will be most directly concerned in the near future. Your graduation from college does not make you a finished engineer, but it will give the foundation on which you can build your career through experience and continued study.

In fact, this foundation resulting from college training is so important to your development as an engineer that you should thoroughly understand and appreciate the objectives of your college work. Fundamentally these objectives are to gain knowledge, to develop the mental skills necessary to utilize this knowledge, and to develop the proper attitudes and personal characteristics which enable you to become a successful engineer and a good citizen. A clearer picture of these objectives is presented in the following outline.

OBJECTIVES OF THE ENGINEER'S COLLEGE TRAINING

I. To Gain Knowledge
   - A. Fundamental laws and principles
   - B. Factual engineering information
   - C. Cultural, sociological, and economic background

II. To Develop Mental Skills
   - A. Facility in expressing yourself both by words and by graphic devices
   - B. Facility in visualizing and comprehending
   - C. Imagination, ingenuity, and resourcefulness
   - D. Ability not only to find sources of information but also to discriminate between pertinent and immaterial information
   - E. Ability to think straight, to reason logically from fundamental principles, and to reach correct conclusions
   - F. Ability to analyze, evaluate, and synthesize (the "engineering method")

III. To Develop Proper Attitudes and Personal Characteristics
   - A. Honesty with facts and men
   - B. Realization of citizenship responsibilities
   - C. Spirit of cooperation with others in a common endeavor
   - D. Leadership
   - E. Industry, initiative, and self-reliance
   - F. Confidence in your ability to learn and to carry on individual studies, investigations, or researches

These objectives are achieved in different ways. The first group and parts A and B of the second are gained largely through your scholastic work. Parts C through F of the second objective and the development of many of the attitudes you need are acquired not so much by the subject matter taught in your courses as by the mental freedom which the method of teaching permits and which your instructors encourage.

The last objective concerns the development of those personal characteristics which are necessary to build both a successful career and an

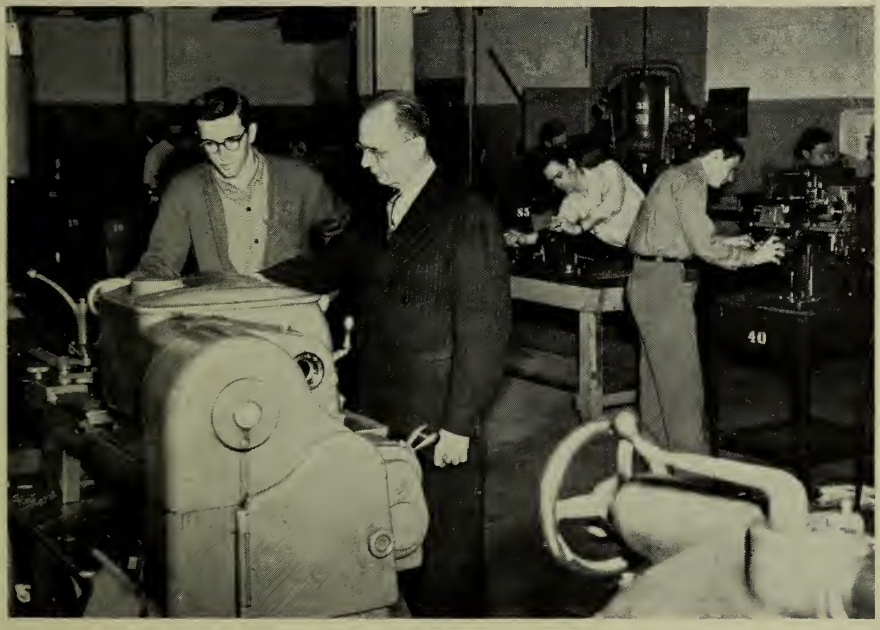
effective personality. Although the first group can be acquired in part through your academic work, development of a good personality calls for informal association with your fellow students and instructors. You will find many opportunities to improve and enjoy yourself socially by attending parties, church activities, banquets, and dances and by participating in the student activities described later in this bulletin.

This recommendation is stressed here because in the past engineers have often been justly accused of having no social consciousness. This deficiency is being remedied more rapidly than many people realize; even so, the engineering student often becomes so engrossed in his academic work that he tends to put off participation in social activities until after graduation, when he thinks he will have more time.

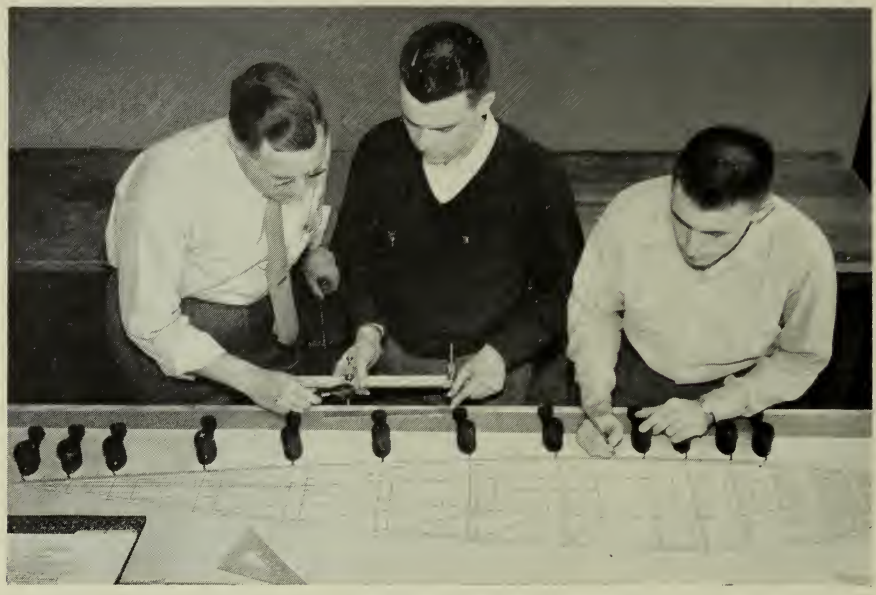
The engineer also needs to develop certain physical skills to at least a moderate degree. These include drafting ability, use of instruments and tools, and skill in arranging and setting up equipment.

A final word about your college work, before we discuss the post-college phase of your formal education.

In each engineering curriculum, provision is made for several hours of elective courses. The object is to permit you to broaden your training



Laboratory work at the Chicago Undergraduate Division where young engineers perform scheduled operations and set-ups according to modern production shop practices



Aircraft drafting and lofting, General Engineering 203

along whatever lines you desire. Therefore instead of regarding these elective courses as a necessary evil in your curriculum, as do some engineering students, you should select each elective to fit into a common purpose. A few of these goals are indicated in the following list:

1. To develop your cultural background.
   Subjects which accomplish this purpose are literature and the fine arts, history, astronomy, languages, etc.
2. To develop your sociological background.
   Subjects that do this include social psychology, sociology, history, economics, political science, geography, etc.
3. To develop a hobby for recreation.
   Subjects in this group can be selected from anything that you are interested in — astronomy, archeology, zoology, botany, literature, music, dramatics, etc.
4. To provide knowledge in subjects related to professional work.
   This group consists largely of isolated courses like economics, accounting, psychology, industrial relations, engineering law, engineering report writing, speech, business letter writing, etc.
5. To develop a combination of engineering and another career.
   To accomplish this purpose most of your electives should be selected from a single area like business administration, education, law, journalism, political science, etc.

The third and final phase of your engineering education is acquired in industry after you graduate. Many organizations have formal post-college training courses which are conducted under any one of several plans. In one plan the course runs for a period of a year. In another the formal training is sandwiched in with your regular work, and the time is usually extended — sometimes up to five years. Other plans may consist of any combination of these extremes, but most large companies also offer refresher courses which you are encouraged to take periodically.

Even though this last phase of your formal education may cease in a few months or years, your education in the true sense never stops. Real education comes from the inside; you educate yourself. Contrary to the belief of many people, education does not mean "the pouring of knowledge into," but rather " 'the leading out of' a state of mental confusion due to lack of knowledge." In the primary schools and in many secondary ones this "leading out of" is done for you by your teachers. In college, and to a still greater degree in your first industrial experience, you take over. You lead yourself out of mental confusion, with only such assistance from your instructors or supervisors as is needed to help you develop this ability. And throughout the rest of your career, your further education lies in your own hands.

ENGINEERING REGISTRATION

Every state, territory, possession, and district of the United States has a law that defines and governs the practice of engineering. So you should understand what registration means, how it will benefit both you and the entire profession, and how it may be obtained.

For a full account, read *Next Step — Registration,* published by the National Society of Professional Engineers, 1121 Fifteenth Street, N.W., Washington 5, D.C. The next few paragraphs give a digest of parts of that booklet.

"Registration places the force and sanction of the law behind the desire of the profession to maintain a clearly recognizable line of demarcation between the engineer and the non-engineer. It places the agencies of the law behind the efforts and aspirations of the profession to maintain high standards of qualification and ethical practice.

"Legal registration of members of the engineering profession is an exercise of the police powers inherent in every state for protection of the public health and public safety. Such registration gives assurance that only those persons who meet fixed educational and experience requirements may practice engineering."

You as an individual will gain in two major ways by going through the registration process: First, you will have authority to practice as an

engineer before the public. Second, you will establish your professional standing on the basis of legal requirements.

Note that, by law, registration is required only of those who "offer their services to the public as professional engineers." But a great many engineers not in this position still find it wise to obtain registration, for at least two reasons — they may later wish to enter engineering practice for the public, and even as private engineers they may greatly benefit from possessing a legal badge of competence (for example, when testifying in court). Furthermore, an increasing number of companies are requiring registration before advancing a man to a responsible position.

You can take your first step toward registration just before or soon after graduation from an engineering college. You do this by passing an examination, after which you receive a certificate attesting to this fact. "This is not a certificate authorizing the practice of engineering but it attests to successful completion of the theoretical requirements for registration. After acquiring the experience deemed necessary under the state law (generally four years) the individual holding an engineer-in-training certificate need only demonstrate that he has obtained the requisite experience in order to obtain his certificate as a professional engineer.

"As in every case of individual state laws, details vary according to the different laws, but essentially the board of registration is interested in knowing that the applicant has acquired the basic knowledge necessary to insure his technical competence as implemented by later experience."

In every college of engineering you will find at least one administrative officer or faculty member — and in most colleges you will find many such men — who can give you full information about the registration requirements of your state, the official name and address of the registration board, and the steps you can take in moving toward registration.

GRADUATE STUDY

Whether to take graduate work, and when, is a complicated decision that requires careful thought. Should you go directly into industry and take advantage of the training courses it offers, or should you stay on and study for the M.S. or even for the Ph.D. degree?

Most men find that a sensible decision can hardly be made before the senior year. We suggest that as a sophomore or a junior you investigate the graduate offerings available in your department and at other universities. A change of schools will help give the broadened viewpoint necessary for successful graduate work. Find out what is needed in the way of background knowledge, ability to use foreign languages, and

The heat treatment of metals in Mechanical Engineering

special technical skills. Learn what graduate assistantships and research fellowships are available at institutions that you might wish to enter.

Make another inventory as you get within a few months of graduation. At that time, too, talk with faculty members and with men in industry about the over-all economic picture and about prospects in the industries that interest you — prospects for you if you go to work after getting your B.S. degree, prospects for you if you have a higher degree.

Even more important, analyze your own capabilities for graduate work. The grades you have made in your undergraduate courses are one index, but only one. What counts most is whether you have such traits as these:

1. Intellectual ability and curiosity
2. Desire to tackle new problems whose solution may or may not be immediately applicable in practice
3. Willingness to combine with this desire a considerable persistence and determination
4. Initiative and originality in planning approaches to a problem and in getting information. Many fields of graduate study demand also more adeptness in the various laboratory skills than many undergraduates possess; some fields demand in addition a broad reading knowledge of one or more foreign languages.

III. CHOOSING YOUR COLLEGE OF ENGINEERING

Choosing the college to attend is a major step in the educational planning of any high school student. Its importance should not be discounted by false reasoning or by lackadaisical attitudes. In some cases, such a decision must be based on meager information and observation, but in general there is no excuse for an inadequate background of facts upon which to base the selection.

What is said hereafter, therefore, is predicated on the assumption that the student's decision to enroll in a college of engineering is based on careful analyses of his interests and aptitudes and on a rather comprehensive knowledge of the nature of engineering and science. He should have fairly full information on what the profession offers its members in the way of satisfying employment, and the monetary compensation his efforts will bring to himself and family. He should not set himself to the rigorous tasks of training and apprenticeship experience that are required of practitioners in this profession unless he is guided and motivated by such analyses and knowledge. When this background of vocational consideration has been fully developed and firmly anchored in a declared intention to enter the profession of engineering through the open door of a college education, it becomes a relatively simple matter to select an appropriate college of engineering.

CRITERIA FOR CHOOSING YOUR COLLEGE

There were 148 colleges of engineering and institutes of technology in the United States offering accredited curricula in 1953. Approximately 34 others had not been accredited. These figures do not include the so-called technical institutes or schools of mechanic arts and the trades. The greater proportion of the accredited colleges and institutes of technology are state-supported. Some are located in privately endowed universities, such as Stanford, Northwestern, Lehigh and others, and some are independently organized and operated, such as the Massachusetts, Illinois, and California Institutes of Technology, Case, and a number of others.

Entrance requirements differ moderately, but tuition costs vary widely among these institutions. So do the buildings, climate, topography, housing, emphasis on sports and extracurricular activities, standards of

The dry pressing of shapes in ceramics showing the die used for pressing circular plates

scholarship, and other well-known attributes of college campuses. All these factors must be appraised and taken into account.

In the final analysis, however, these usual and somewhat obvious features of college life must be weighed and balanced against the more important factors of faculty, facilities in the way of modern laboratories and equipment, and the curricula which an institution has to offer.

Institutions may also be compared in the light of the reputation and prestige they have attained in the eyes of the general public and in the esteem of the profession. These aspects are less tangible, and less evident

to the high school student, than the more glamorous and obvious aspects of the college picture, but they are much more important and worthy of careful consideration.

Primarily, a college of engineering must be judged by the strength of the curricula it offers. This depends, of course, both upon competent, adequate instructional staffs and upon modern, well-equipped laboratories and classrooms. Functional and well-designed buildings are also important. Not every school can offer all the curricula that cover the different fields of engineering. To be considered at all, a curriculum should bear the seal of approval of the Engineers' Council for Professional Development, the recognized accrediting agency. The agency's ratings are matters of public record.

Comparisons of curricula, staff, and facilities of the various institutions can be made most easily through studies of the published catalogs and bulletins of the different colleges. These are or should be on file in the libraries and offices of counselors and administrators of every high school. They may be obtained without cost by writing directly to the deans of engineering of the institutions in which one is interested.

The prospective engineering student may, if he chooses, postpone the final selection of his engineering college for one or two years after graduation from high school, by attending a college of liberal arts and sciences or a junior college that offers pre-engineering courses and curricula. Many of these programs of study are patterned on the prescribed requirements of standard engineering colleges and orient the student to the type of training that engineering requires.

ENGINEERING ALUMNI COMMITTEE

To aid high school officials in their regular vocational guidance and career programs, insofar as the engineering phases of these programs are concerned, the College of Engineering has formed a state-wide engineering alumni counseling committee that eventually will serve every high school in the state of Illinois and some cities in border states. The committee began its services to the schools in the fall of 1952 on a moderate scale, and is rapidly extending its operations to all parts of Illinois.

This new service to the high schools is organized by the College of Engineering Advisory Committee, which is composed of prominent engineers from all sections of the country. One or more local practicing engineers will be available in each designated school area of the state upon call of the local school officials. The service rendered consists mainly of informational discussions with high school students regarding the various aspects of engineering and scientific work and the necessary educational preparations for it.

More complete information concerning this service may be obtained by writing to the Dean of the College of Engineering, 106 Civil Engineering Hall, Urbana, Illinois.

OTHER SOURCES OF INFORMATION

Supplementing the various counseling agencies of high schools and engineering organizations is the series of books, to be found in any library, on the personal and educational requirements of those who practice the profession of engineering. "Careers in Engineering" is but one of more than a dozen available to the inquiring high school student, his parents, and teachers.

The following books and pamphlets are recommended for reading by high school students and counselors in considering engineering as a career.

Books

1. The Engineer, His Work and His Education, by R. L. Sackett. Ginn and Company, Boston, Mass., 196 pages, $1.40. Seven divisions of engineering described. Twelve short biographies of great engineers.
2. Vocational Guidance in Engineering Lines; edited by Waddell, Skinner, and Wessman. American Association of Engineers, Mack Printing Company, Easton, Pa., 521 pages and index. Excellent descriptions of 26 special fields of engineering, written by practicing engineers.
3. Engineering Opportunities; edited by R. W. Clyne. D. Appleton-Century Book Company, New York, N. Y., 537 pages. 26 chapters, each on an industry; some for older readers; of value in counseling.
4. The Story of Engineering in America, by Chelsea Fraser. Published by Thomas Y. Crowell Company, 393 Fourth Avenue, New York, N. Y.
5. The Engineering Profession, by T. J. Hoover and J. C. L. Fish. Stanford University Press, Stanford University, Calif., 1941, 441 pages.
6. What Engineers Do, by W. D. Binger. From material originally prepared for boys about 12–14 years old, but not written down to them. Especially good for laymen who need nontechnical descriptions. W. W. Norton & Company, 101 Fifth Avenue, New York 3, N. Y. Revised edition, 1938.
7. The Right Career for You, by Eugene J. Benge, President, Benge Associates, Management Engineers. Funk & Wagnalls Company, 153 E. 24th Street, New York 10, N. Y., 1950, 159 pp., $5.00.
8. Books About Jobs, by Willard E. Parker. Published by the American Library Association, Chicago, Ill., 1936, 400 pages. Section on engineering occupies 21 pages. This is an annotated bibliography of books, pamphlets, and articles in periodical literature.
9. Occupational Index; a quarterly supplement to Books About Jobs. Published by the Occupational Index, Inc., New York University, New York, N. Y., from January, 1936, to date. Each issue lists recent books, pamphlets, and magazine articles on engineering as a career, and similar publications on all other occupations.

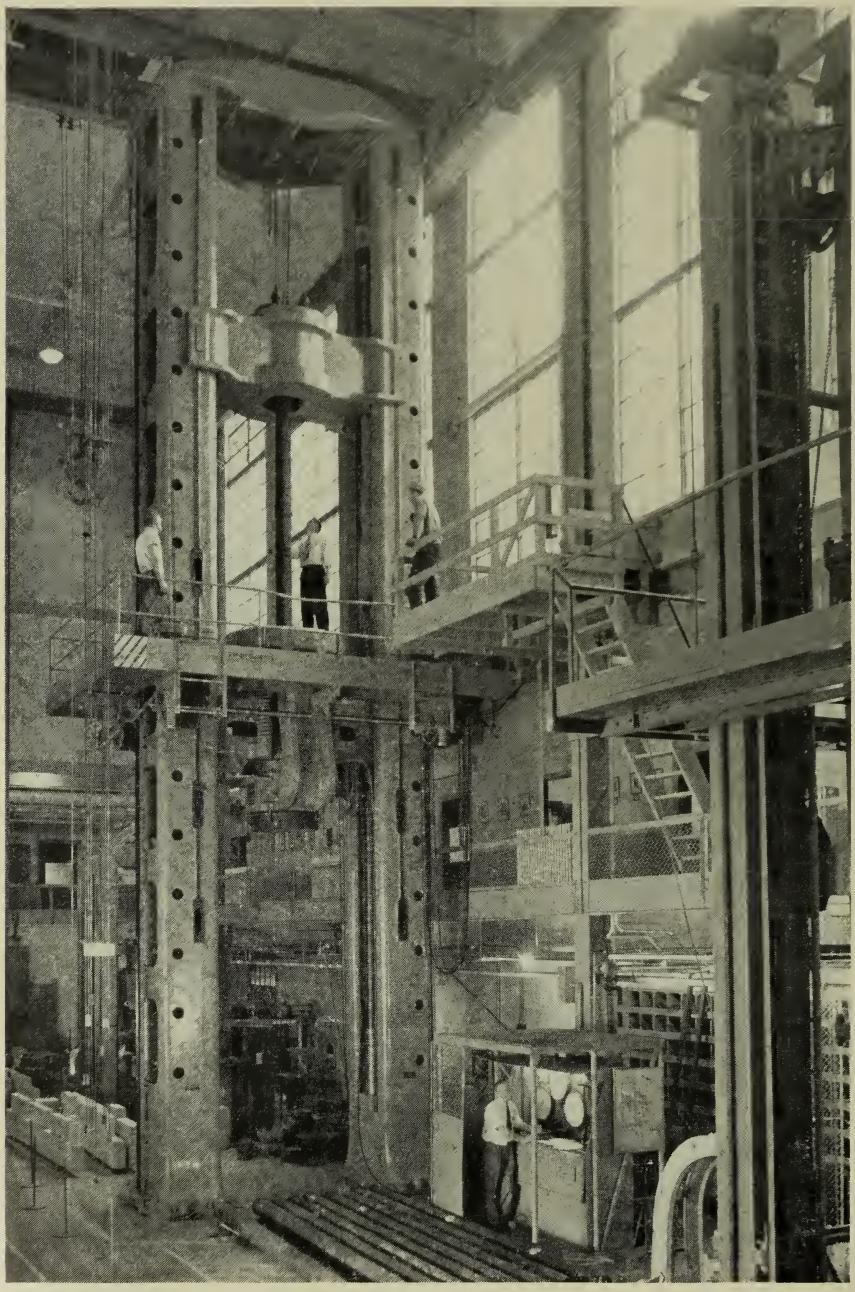
Pamphlets

1. Engineering as a Career, Engineers' Council for Professional Development, 29 West 39th Street, New York 18, N. Y., 1942. 36 pages, 15 cents per copy; 10 cents for 50 or more.

2. Annual Report, Engineers' Council for Professional Development, available at 29 West 39th Street, New York 18, N. Y., about January 15 each year. Gives latest list of accredited curricula in engineering; 50 cents per copy. Report also contains reports of seven committees, viz., Guidance, Education, Student Development, Professional Training, Recognition, Ethics, and Information. The list of accredited curricula by itself is usually available by December 15 and sells for 25 cents per copy.
3. Career in Engineering — Requirements and Opportunities, by Lowell O. Stewart (Head, Department of Civil Engineering, Iowa State College), 92 pages, 75 cents.
4. Vocational and Professional Monographs — series by various officers in several branches of engineering and other fields; priced up to 75 cents per copy. Published by Bellman Publishing Company, Inc., 6 Park Place, Boston, Mass.
5. The Outlook for Women in Architecture and Engineering. Bulletin 223-5, U. S. Department of Labor (Women's Bureau). One of a series of 8, of which 223-1 is "Outlook . . . in Science." Superintendent of Documents, Washington 25, D. C., 25 cents (stamps not accepted).
6. The Most Desirable Personal Characteristics . . . , Engineers' Council for Professional Development, 29 West 39th St., New York 18, N. Y. An exploration of opinion. 28-page pamphlet, with charts, 1948, 25 cents.
7. A Professional Guide for Junior Engineers, Engineers' Council for Professional Development, 29 West 39th St., New York 18, N. Y. A guide for college students and young graduate engineers. By W. E. Wickenden; G. R. Henninger, editor. 64 pages, 1949. 25% discount on 10 or more. $1.00.
8. Guidance Manual for Engineers. Published by the Engineers' Council for Professional Development, 29 West 39th Street, New York, N. Y., 15 pages, 15 cents.
9. Shall I Study Engineering? A questionnaire supplement to the Guidance Manual. Eight pages, 10 cents.

PART II

THE UNIVERSITY OF ILLINOIS COLLEGE OF ENGINEERING



The 3,000,000-lb. hydraulic testing machine capable of handling specimens 38 ft. long is used to study the behavior under load of large members

IV. POLICIES

The College of Engineering stresses these aims — aiding students to think clearly and accurately, giving them the fundamentals of sound engineering, and affording them opportunities to put into effect the doctrine that one of the engineer's main functions is to contribute to effective practical action. All this implies treating the student as an individual and encouraging his initiative and self-reliance.

The College, then, emphasizes a thorough grasp of the engineering method and of basic laws and principles, rather than mere familiarity with processes that may change in time and vary from place to place. The College also urges every student to begin gaining a comprehensive view of the economic and social world in which he lives, and an understanding of his place in it, as well as a firm grasp of scientific and technological fundamentals. It encourages him to take full advantage of the resources of the large university to which the College belongs. Finally, administrators and teachers proceed on the belief that the engineer's knowledge, skills, and judgments are of little avail until they are communicated to others and serve as the basis for action.

These basic policies yield several corollaries: small classes and individual contact with instructors; a system of faculty advisers; student participation in research; no sharp separation between a staff member's teaching and research but, instead, stress on the desirability of his engaging in both activities; and a continuous appraisal, by the departments and by the College, of the methods of teaching and counseling which they use.

In addition, the College considers that its obligations include helping students to find jobs in industry and government which will utilize their specific abilities to the best interest of the student himself, of his employer, and of society as a whole.

V. BUILDINGS AND EQUIPMENT

AERONAUTICAL ENGINEERING

The office of the Department of Aeronautical Engineering is in the Transportation Building. Classroom space is located in the Transportation Building and in Aeronautical Engineering Laboratory B.

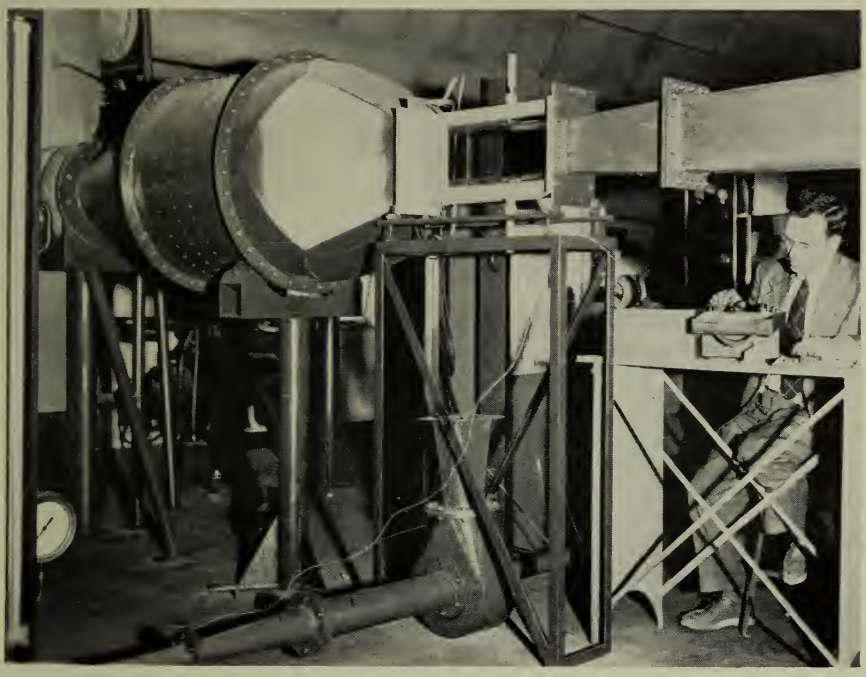
The laboratory facilities are located on the university campus and at the University of Illinois Airport. Modern equipment is available for investigating fundamental principles taught in the classroom, for demonstrating basic testing techniques, and for carrying on research.

Aerodynamics Laboratory. A horizontal, return-flow wind tunnel having a 30-by-48-inch test section and an air velocity of 130 miles per hour is located in Aeronautical Engineering Laboratory A. Additional wind tunnels for specialized investigations, and apparatus for visual observation of air flow, are installed in Aeronautical Laboratory B.

Aeronautical Laboratory B also houses one of the most modern "shock tubes" in the country. This provides facilities for studying many of the phenomena occurring in air flowing at supersonic velocities.

Two compressed air facilities are installed in the Flow Laboratory at the University Airport. One of these provides a continuous flow of air for a high-speed wind tunnel which is used for making tests at air speeds up to twice the speed of sound. The other air facility produces high-pressure air for a "blow-down" type of wind tunnel in which tests may be made at air speeds up to three times the speed of sound. Modern methods of instrumentation are available for obtaining data from these tunnels.

Aircraft Power Plant Laboratories. The experimental facilities for the study of aircraft power plants are located at the University Airport. Facilities have been provided for experimentation and research on the components of present and future reaction engines. The combustion tunnel provides facilities for the study of gas turbine and ram jet combustion chambers as well as facilities for work on gas turbine nozzles and turbine wheels. The high-velocity jet supplies air for testing ram jets and pulse jets under actual and simulated flight conditions. A cascade wind tunnel is available for study of turbine and compressor blading. In addition, a supersonic induction wind tunnel is available for investigating engine components under simulated altitude conditions.



Transonic wind tunnel in the Aeronautical laboratory — models may be tested in this tunnel at air speeds up to twice the speed of sound

Aircraft Structures Laboratory. The equipment in this laboratory enables students to see how aircraft materials and airframe components act when subjected to static and dynamic loads. Modern methods of applying loads to the test specimens and of recording test data are employed. To illustrate various types of structural design, a large variety of sample structures is available for study and testing. These facilities are located in Aeronautical Laboratory B on the campus.

General Facilities. A well-equipped shop is provided for the purpose of constructing laboratory equipment, test specimens, and models.

To aid in demonstrating the design features and function of various aircraft components, mockups and sections of complete aircraft and parts are readily available.

Under the direction of the Institute of Aviation, the University operates a 763-acre modern airport with three concrete runways, each 5300 feet long.

More than 30 University-owned aircraft are operated for student instruction and research purposes.

Complete Civil Aeronautics Administration approved maintenance facilities are available, so that aeronautical engineering students have an excellent opportunity to observe maintenance problems. Airplane design classes may study current design practices, as used on several types of aircraft, by inspection of aircraft in the maintenance shops. Facilities for complete construction of aircraft are available.

The University Glider Club flies from this airport, and repairs and constructs its flight equipment in the airport shops.

The University Institute of Aviation acts as a coordinating agency for aeronautical research within the University. As a result several departments not normally associated with aeronautical activities are conducting research at the University Airport in some phases of aviation.

AGRICULTURAL ENGINEERING

The Agricultural Engineering buildings are located at the south end of the campus. The main building is used for offices, classrooms, teaching, laboratory space, and shops. The new building just west of it is an initial unit of the multi-story structure planned for Agricultural Engineering. This building provides space for the research which is carried on by the department as a unit of the Agricultural Experiment Station. The buildings of the University Farm are used for research and class demonstration, and the department is assigned a portion of the farm for research and teaching purposes.

Machinery Laboratory. An extensive collection of farm implements is provided for classroom and laboratory study of the adjustment, construction, and design of this equipment.

Tractor Laboratory. Many stationary gasoline and diesel engines as well as tractors and motor-generator sets are available for laboratory work in farm power. Three sets of dynamometer equipment for measuring belt horsepower of tractors and stationary engines give students a chance to study at first hand the power and fuel consumption relationships in engine performance. Drawbar dynamometer equipment is also used in tractor tests. Engine operation with liquefied petroleum gas, gasoline, and diesel fuel is compared. The latest models of motor tuneup testing equipment are provided. The laboratory includes facilities for testing motor oils and fuels.

Farm and Home Equipment Laboratory. This laboratory provides facilities for study and test of the electrically driven equipment used around the farmstead and the home — pumping systems, feed grinders, conveying equipment, heating equipment, ventilating systems, and home appliances such as refrigerators, deep freeze units, etc. These units assist in the study of the effective application of electricity to improve labor

Agricultural engineers study the use of electricity for feed grinding, crop processing, and farm chore mechanization

efficiency in farm chores and to reduce the amount of heavy work in such operations as cattle feeding, barn cleaning, etc.

Drafting Room. The laboratory work in the various fields of structures design, soil and water engineering, and design of farm machinery is carried on in the drafting room in the main building.

Research Laboratories. Each of the divisions of the department has space allotted in which to carry on its research program.

In the main building there is a special dehydration laboratory for the study of conditions of humidity and temperature for drying and storage of field crops.

Research into feed grinding and handling problems, soil and water engineering, structures, tractors, and machinery is carried on in the new Research Laboratory. This space is also shared by the personnel of the United States Department of Agriculture who cooperate with the department in many phases of research on farm problems. Further investigations in structures are made on several buildings on the University Farm.

A machine shop in the main building is used for the construction of research equipment and experimental models and for the maintenance of the machinery in the various laboratories.

CERAMIC ENGINEERING

The Department of Ceramic Engineering has a modern, well-equipped building including laboratories, classrooms, offices, museums, and storerooms. Special laboratories are located in the Kiln Laboratory, which is adjacent to the Ceramics Building.

Museum. The departmental museum specimens illustrate the industrial phases of ceramics and include a large collection of ceramic ware acquired through purchases and gifts. These pieces are representative of both American and foreign ware.

Ceramics Library. In the department is one of the most complete libraries in the United States devoted to ceramics and to those parts of the physical and chemical sciences which are important in its study. The library contains 3500 volumes, and receives 39 current periodicals and journals.

General Ceramics Laboratories. The laboratory courses in ceramic raw materials, bodies and glazes, and enamels are conducted on the first floor of the Ceramics Building. In addition to complete facilities for laboratory experiments in the field of ceramics, the student is afforded opportunity to gain realistic experience in the operation of semiplant- and plant-size equipment in his laboratory work. The laboratories contain all the apparatus and equipment required for the processing of materials, so that pottery, glasses, glazes, refractories, and enamels can be studied and tested.

Glass Laboratory. Both class work and research work are done in this laboratory. Specially constructed high-temperature furnaces are used for the melting of experimental glass compositions. The equipment necessary to determine the physical properties of glasses is available.

Whiteware Laboratory. The whiteware laboratory is employed for instruction in the preparation of body mixtures, for demonstration and practice in the various methods of whiteware production, and for the making of special articles used for class and research work. It houses the equipment for the processing of raw materials and for the production of various types of porcelain dinnerware, electrical porcelain, artware and pottery products by the various methods used in industrial manufacture. Associated with the whiteware laboratory is a mold shop in which plaster molds are made for class and research work.

Kiln Laboratory. The Kiln Laboratory, 100 by 42 feet, houses the semiplant- and plant-size equipment, kilns, and furnaces. The eight oil- and gas-fired kilns range in capacity from 5 to 50 cubic feet and attain

temperatures up to 3000 degrees Fahrenheit. Two rotary smelters and eight pot-type smelters are used for the preparation of enamels and frits for glazes. Six electric furnaces with chambers up to 14 cubic feet capacity are used for special firing operations. Unusually complete equipment for the recording of temperatures and for automatic control of firing operations is a feature of this laboratory.

Enamel Laboratory. The enamel laboratory, designed for instruction and research in vitreous enameling, is completely equipped for the chemical cleaning and pickling of sheet iron and the sandblasting of cast iron. Several types of furnaces for the smelting of all types of enamels are available. The related apparatus includes some of the most modern equipment for dipping and spraying.

The enamels are fired in six electric furnaces, all controlled automatically. The furnaces cover a wide range of sizes, the largest having a chamber 24 inches by 24 inches by 40 inches. The testing equipment includes many pieces of apparatus used commercially for research and control in the enameling industry.

Structural Clay Products Laboratory. A part of the floor space in the Kiln Laboratory is utilized for machinery equipment, including a complete brick-making unit and smaller auger machines for extruding small shapes. Crushing and mixing machinery, a hydraulic press of 400,000-pound capacity, and a dryer with automatic controls are a part of the equipment of this laboratory.

Drying Laboratory. Experiments in the drying of clay products and studies of the fundamental principles involved in drying are conducted in a drying cabinet with forced air circulation and automatic control of temperature and relative humidity.

Microscopy Laboratory. The microscope equipment includes instruments with complete accessories for both instruction and research. A large collection of samples illustrates the characteristics of both natural and synthetic ceramic materials. Particles of all sizes falling within the whole range of optical visibility can be studied and photographed in the microscopy laboratory.

Research Laboratories. Research is an important function of the department, and excellent equipment is provided in several laboratories reserved for research purposes. For investigations which must be conducted at high temperatures, a variety of furnaces capable of close temperature regulation, and some with atmospheric control, are available. Complete modern X-ray equipment is included for the investigation of materials and products.

CHEMICAL ENGINEERING

The Chemical Engineering Division of the Department of Chemistry and Chemical Engineering is in the new East Chemistry Building, which was completed in 1950. This is one of the largest and best equipped laboratories of its kind in the United States. An area of approximately 65,000 square feet is devoted to instruction and research in this field. The main features of the building are as follows:

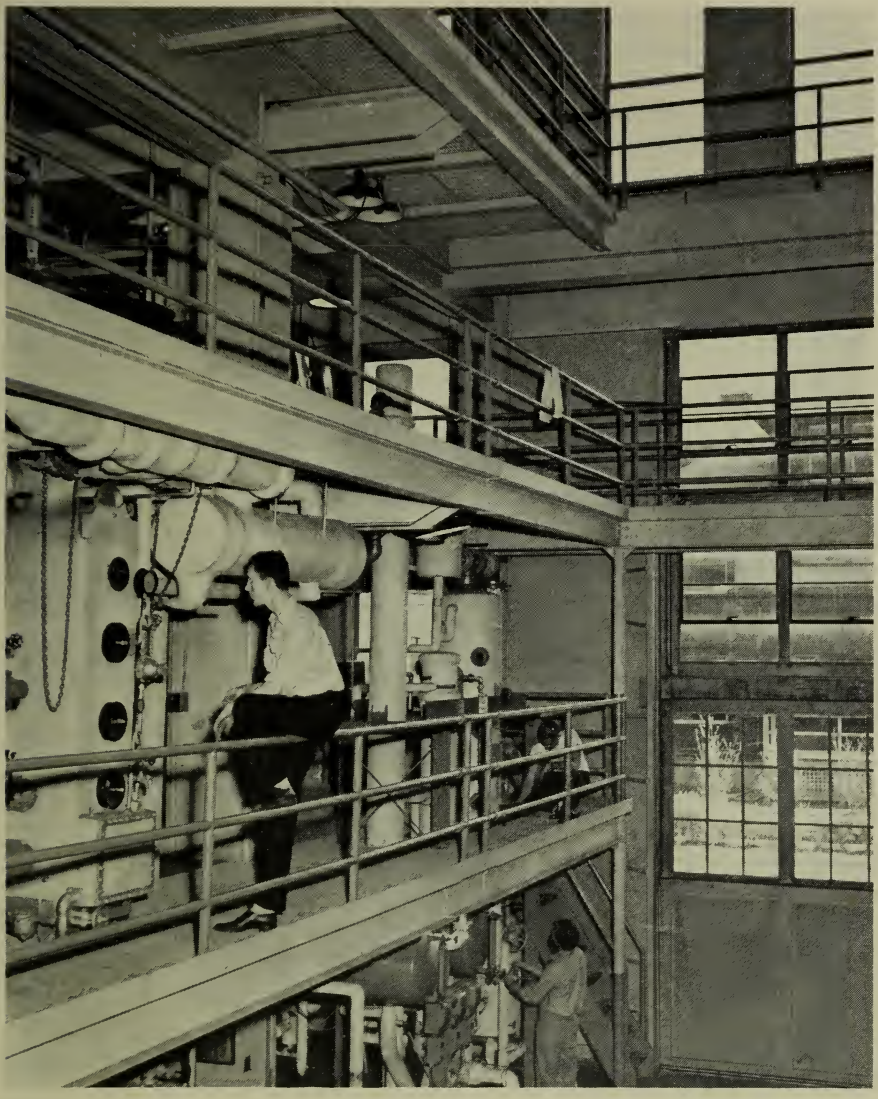
Unit Operations Laboratory. This laboratory occupies three full floors of the building. Tall equipment, such as distillation columns, evaporators, absorption columns, etc., is erected through steel grill mezzanines surrounding a central crane bay. Smaller equipment, such as filtration units, driers, and apparatus for the study of the flow of fluids and heat transfer, has been installed in areas of lower headroom. This equipment is used by senior students in chemical engineering. Shops and storerooms are conveniently located near the laboratory.

Compressors and high-capacity blowers to provide air for the various pieces of experimental equipment are located in an acousticized room adjacent to the unit operations laboratory. These machines include a 75-horsepower 300-c.f.m. (cubic feet per minute) Sullivan Air Compressor to provide air at 125 pounds per square inch pressure; a 2000-c.f.m. Buffalo blower to provide air at 25 inches; a 5000-c.f.m. blower to provide air at 6 inches; a 200-c.f.m. Roots-Connersville Compressor to provide air at 7 pounds per square inch.

In order to remove gases used in large quantities in the unit operations laboratory, two stacks, one on each side of the room, run through to the roof level.

Projects Laboratory. This laboratory is on the second and third floors of the building, adjacent to the unit operations laboratory. It provides facilities for undergraduate training in the operation of process equipment, such as nitrators, sulfonators, chlorinators, extractors, etc. A packed distillation column with fifty equivalent plates is also available for student operation. The laboratory is used for project work in which individual students are assigned jobs similar to those encountered in the chemical industry. Consequently, much space is allotted to equipment to be designed and built by the students themselves.

Process Development Laboratory. This laboratory is on the fourth and fifth floors of the building, immediately above the unit operations laboratory. One of the two stacks that are adjacent to the unit operations laboratory passes through this laboratory so that large quantities of gases can be discharged into the air. Adjacent to the laboratory is a small room equipped with the usual chemical laboratory facilities. This



Evaporation equipment in the three-story Unit Operations laboratory of the Chemical Engineering building

is used for control analyses in the operation of the pilot plant equipment. The space and facilities in these rooms are suitable for the operation of a small chemical plant for test purposes.

There is an opening 4 feet by 8 feet with removable steel plates in each of the main floors of the process development laboratory and each

of the balconies of the unit operations laboratory immediately below. This provides a space for extra-tall equipment, and a convenient duct through which piping may be carried from overhead tanks to each floor of these laboratories.

Measurements and Instrumentation Laboratory. This laboratory contains apparatus for studying the methods used in measuring pressure, temperatures, rates of flow, and liquid levels, and for controlling and recording these quantities. A student-designed process unit for automatic control is installed in one part of the room.

High Pressure Laboratory. Located on the first floor, this laboratory contains equipment used by seniors and graduate students for studying the physical properties of gases and liquids and for chemical reactions at pressures up to 15,000 pounds per square inch. Facilities for extreme high pressures up to 10,000 atmospheres are mounted in a protected recess in the floor. This laboratory contains automatic control and recording instruments on a central panel.

Electrochemistry Laboratory. A large laboratory on the first floor is provided with the necessary vats and electrical equipment for all types of electrochemical operations. The laboratory also contains a small-scale industrial electroplating plant. A motor generator set in an adjacent room supplies D.C. power for this laboratory and to the rest of the East Chemistry building.

Boiler Water Research Laboratory. The study of boiler water conditioning for the prevention of corrosion, embrittlement, and deposits is carried on in this laboratory. It contains high-pressure boilers, water treating units, and control and analytical devices.

Bioengineering Laboratory. The bioengineering laboratory is equipped for the study of fermentation processes. It contains equipment for incubation, sterilization, extraction, purification, and concentration of biological materials.

Miscellaneous Facilities. Adjacent to the unit operations laboratory are rooms containing a refrigeration system, a low-temperature room, high-capacity air compressors, and furnaces. The latter include gas, electric resistance, and induction type units. A large drafting room for a senior course in chemical plant design is located on the second floor.

Other facilities include a constant temperature and humidity room, a large grinding and crushing laboratory, two machine shops — one for construction and maintenance personnel, and one for students and faculty — a 200-seat lecture room with projection booth, a small departmental library, a seminar and student clubroom, a locker and shower room to permit the students to change clothes for laboratory work, and

ample ventilation machinery located in the basement and penthouse of the building to remove objectionable odors from the laboratories.

CIVIL ENGINEERING

The teaching and research activities of the Department of Civil Engineering are conducted in large portions of two major buildings — Civil Engineering Hall and Talbot Laboratory — and completely occupy three smaller buildings — the Sanitary Engineering Laboratory, the Surveying Building, and the Hydraulic Engineering Laboratory.

Civil Engineering Hall. This building, one of the first Illinois engineering buildings, houses the departmental offices, design rooms to provide tables for junior and senior civil and sanitary engineering students, and a similar room restricted to the use of graduate students. The Engineering Library, also located in this building, is described on pages 69-70.

Talbot Laboratory. The Arthur Newell Talbot Laboratory is the outstanding building of its kind in the country. Its floor area of 82,000 square feet is shared by the Department of Civil Engineering and the Department of Theoretical and Applied Mechanics. It houses the following laboratories for testing, research, and instruction.

The *structural* laboratory is in the large central crane bay, where testing machines varying in capacity from 30,000 pounds to 3,000,000 pounds are located. The three-million-pound machine has a vertical height sufficient to accommodate tension and compression specimens 38 feet long. Large machines for determining the fatigue strength of full-size structural members are important features of this laboratory, which is served by a traveling crane. The *concrete* laboratory is equipped for the undergraduate study of proportioning and mixing concrete and of its physical properties. The *highway materials* laboratories are equipped for tests and research in bituminous and nonbituminous highway materials. The *soils* laboratories are equipped to perform the various soil tests, and provide excellent facilities for teaching and research. The *wood* laboratory is equipped for the various tests of wood specimens and for testing joint-connected wood structures.

Sanitary Engineering Laboratory. This building is modern in every respect and well equipped. It has a floor area of 5000 square feet and provides classrooms, offices, and laboratories for instruction and research in sanitary engineering. Large tanks 10 feet in diameter, of various heights, are an important feature of this building. The tanks are intended mainly for the primary treatment of sewage in preparation for use in research, for the collection of fresh sludge and well-digested sludge, and for the generation of gas through the digestion of sewage solids. Sewage

Main entrance of the Summer Surveying Camp in northwestern Minnesota

is supplied by a connection with the main city outfall sewer adjacent to the building. Research in the purification of water, in the treatment of sewage and of industrial wastes, and in other branches of sanitary engineering requiring hydraulic, chemical, and biological equipment is being carried on in the Sanitary Engineering Laboratory.

Surveying Building. This building is near the surveying fields on the south campus. Its floor area of 9400 square feet is divided among drafting rooms, classrooms, offices, and an instrument room equipped with transits, levels, plane tables, and other instruments for plane and topographic surveying, precise levels and theodolites for geodetic surveying, and special instruments for aerial mapping.

Summer Surveying Camp. The University leases from the U.S. Forest Service a large camp in the Chippewa National Forest in northwestern Minnesota. The camp is near the headwaters of the Mississippi River in a secluded region with topography ideally suited for practice in plane, topographic, and route surveying, and numerous lakes and streams for hydrographic surveying. The 17 large buildings are on high ground between two small lakes and are one-half mile from Lake Rabideau.

which is 2½ miles long. There are facilities to take care of feeding and housing 150 students and 15 faculty members. The facilities also include drafting rooms, a classroom, a library, a recreation room, a small infirmary, and several service buildings. The nearby lakes offer excellent opportunities for swimming, canoeing, and fishing; the surrounding forest area attracts men interested in hiking; and there are playing fields for outdoor games. Civil engineering students attend the camp during the summer between their sophomore and junior years.

Hydraulic Engineering Laboratory. The Hydraulic Engineering Laboratory occupies a space of approximately 10,000 square feet. It is provided with a pumping capacity of 2500 gallons per minute at heads from 40 to 45 feet. Storage and sump facilities furnish 22,000 gallons.

Instrumentation is of the latest types. A unique feature of the laboratory is a heated space 10 feet wide and 330 feet long equipped with a traveling crane for handling heavy equipment.This space is well adapted to studies relating to either open channel or pipe flow.

Within the laboratory are complete shop facilities for the construction of models, including apparatus for moulding plastic materials.

ELECTRICAL ENGINEERING

The Electrical Engineering Department is housed in three buildings — the Electrical Engineering Building, the Electrical Engineering Annex, and the Electrical Engineering Research Laboratory.

The Electrical Engineering Building, completed in 1948, is considered one of the most modern in the world. It contains well-equipped classrooms and laboratories for use in teaching undergraduate and graduate students. In all the laboratory courses emphasis is placed on "Why does it work?" (background theory) rather than on "How is it built?"

In the field of *communication and electronic engineering* there are five laboratories — the audio-frequency laboratory, the radio laboratory, the ultra-high frequency laboratory, the antenna laboratory, and the electronic laboratory. All have modern equipment and measuring instruments. The working areas are spacious and well illuminated.

A large part of the work in *illumination engineering* is conducted in a unique illumination demonstration laboratory. The general lighting in this laboratory is obtained from many types of lighting fixtures which show modern designs in fluorescent, mercury-vapor, and incandescent equipment. Around the perimeter of the room are many other fixtures used in commercial and industrial lighting, including cove sections, colorama coves, and luminous panels. This laboratory is equipped for

A demonstration in the Illumination Engineering laboratory

demonstrating illumination principles such as the factors involved in seeing; color effects; shadow effects; light control by reflection, transmission, and refraction; black light phenomena; and the effect of room proportions and surfaces on the utilization of source light.

Electric power engineering employs three laboratories. The machinery laboratory contains a wide variety of motors, generators, transformers, and other specialized electrical machines. In addition to possessing a very high level of illumination for safety, this laboratory is also soundproofed to provide comfortable surroundings for the engineering student. The power transmission laboratory has specialized equipment for the study of power transmission, power system metering, and power system relaying. In the network analyzer laboratory complete power systems can be set up in miniature and studied under various operating conditions.

The Electrical Engineering Building has special laboratories for the study of electrical circuits, electrical measurements, and servomechanisms. The building also contains well-equipped shops manned by skilled mechanics for the maintenance of equipment and the construction of a great variety of new apparatus to meet the needs of new areas in electrical engineering.

The Electrical Engineering Annex contains a photometric laboratory and an illumination research laboratory. The photometric laboratory contains exceptionally complete equipment for making measurements of

radiation in the visible spectrum, including equipment for colorimetry, making this laboratory outstanding in the field.

The Electrical Engineering Research Laboratory is used entirely for research purposes. The areas covered in this research include electron tubes, gaseous conduction, antennas and fields, high-frequency instrumentation, semi-conductors, ultrasonics, electrical machinery, and power transmission and distribution.

GENERAL ENGINEERING

The classrooms, drafting rooms, and offices of the Department of General Engineering are in the Transportation Building. The department occupies the second, third, and fourth floors and part of the first floor. There are eleven drafting rooms designed to accommodate a maximum of twenty-four students each. A sufficient number of rooms are equipped with drafting machines and parallel rules so that each student becomes familiar with their use.

The reproduction rooms on the fourth floor are equipped to reproduce drawings by any of the modern methods. Among other things this equipment includes two blueprint machines, an Ozalid machine, a B & W developer, a Photostat, a reflex printer, and an electric drier. There are also a printing press and a file of several thousand etchings for printing problems for student use.

The department owns several hundred special drafting tools and devices which are available to staff and students for special problems.

The department also has projection equipment, slides, film strips, and movies for its teaching program as well as a wide variety of models in wood, metal, and plastics. A well-equipped model shop is operated for the construction and maintenance of models and other visual aids.

MECHANICAL AND INDUSTRIAL ENGINEERING

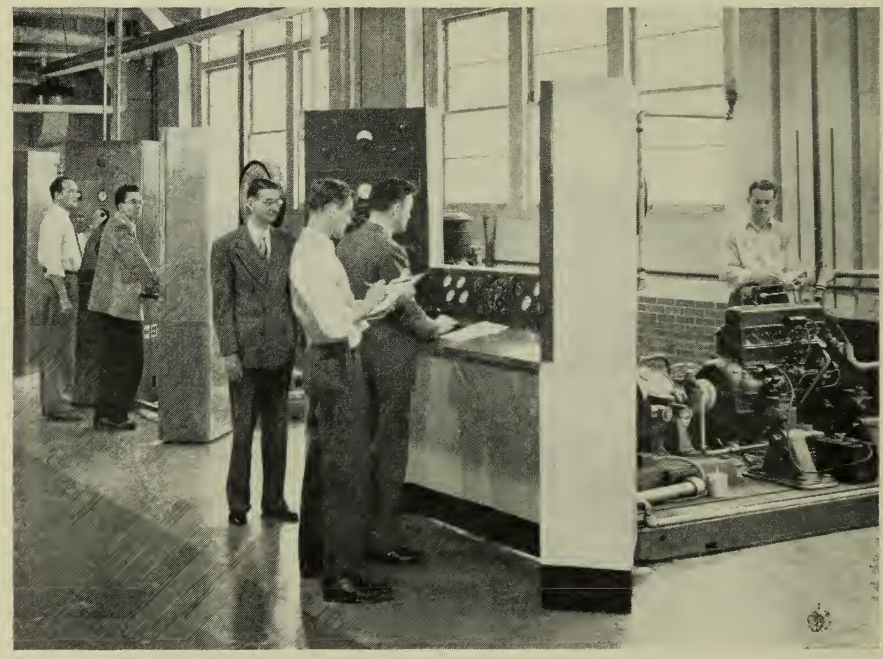
The Department of Mechanical Engineering administers the curriculum in industrial engineering also, and the physical facilities used by students in both the mechanical and the industrial engineering programs are described in the present section.

The Department of Mechanical Engineering occupies three buildings for classrooms, offices, and laboratory space — the Mechanical Engineering Building, the Mechanical Engineering Laboratory, and a portion of the Foundry and Woodshop. All laboratories serve a twofold purpose in that they provide space for equipment upon which research may be accomplished at both the graduate and undergraduate levels and also provide space for equipment upon which demonstration and application of basic principles may be portrayed.

Laboratory facilities for the power phase of mechanical engineering are as follows.

1. The power laboratory is located in the Mechanical Engineering Laboratory. Here the student makes performance tests of equipment and verifies various thermodynamic processes discussed in the classroom. The equipment includes refrigeration units, air compressors, pumps, centrifugal fans, a brake tester, a belt tester, a heating, ventilating, and air conditioning unit, and all the instruments necessary to conduct tests. One unique piece of equipment is the General Electric educational unit, which consists of two turbines connected to 220-volt A.C. generators and an oil-fired boiler which will generate steam at 1500 pounds per square inch and 900 degrees Fahrenheit. This equipment may be used to simulate the operation of a power plant.

2. The internal combustion laboratory in the Mechanical Engineering Building is one of the most modern in the country. It contains gasoline and diesel engines connected to dynamometers for purposes of performance testing. In addition there are two special single-cylinder engines, one a diesel and one a gasoline engine, so arranged that they may be supercharged or the compression ratio changed while in operation. These



The Internal Combustion Engine laboratory

are used to determine effects due to changing compression ratio and supercharging and also to test various fuels. There is also a full-scale engine testing room in which an air-cooled aircraft engine is connected to a dynamometer. The unit permits changing intake and exhaust pressures to simulate altitude conditions from 1000 feet below sea level to 20,000 feet above sea level; the temperature may be varied from —40 degrees to 150 degrees Fahrenheit.

Laboratory facilities for the production phase of mechanical engineering are as follows:

1. A metal casting and pattern laboratory where students study and apply the methods of melting, handling, and pouring molten metal both ferrous and nonferrous. Various types of molding equipment, a cupola, nonferrous metal furnaces, and equipment for pouring molten metal are available.

2. A sand-testing laboratory and core room where the student gains experience in determining the properties of molding sand and core sand, and their effect upon the quality of finished castings. The equipment includes a universal sand-testing machine, a sand specimen rammer, a moisture teller, a deflocculator, a core oven, and sieves for determining sand size.

3. A metal-processing laboratory which contains more than 100 machine tools for the machining of metal parts. Here students acquire knowledge and experience in the art of metal processing.

4. A laboratory for the heat treatment of metals where the student acquires a knowledge of metals with respect to heat treatment and its effects upon the properties of the metal. The laboratory contains gas furnaces, electric furnaces, gas carburizing furnaces, and a high-frequency induction unit as well as microscopes, polishing and etching equipment, and basic instruments — tensile testing machines, hardness testing machines, hardenability testing equipment — for physical tests of specimens.

5. A tool design laboratory where the students study the tools to be used, the method of handling the materials, and the arrangement of equipment and machines as applied to the manufacture of a product. The equipment includes a selected group of jigs, fixtures, dies, and other basic production tools, and also a model of an industrial plant with model machines for visual studies of the problem of industrial planning.

6. A motion- and time-study laboratory where principles of motion and time study are applied to factory problems. The laboratory contains projection equipment, material bins of proper design to demonstrate good work-space layout, time-study equipment, and movie cameras to record data for micro-motion study.

Laboratory and classroom facilities available for the design phase of Mechanical Engineering are as follows:

1. Six drafting and design rooms where the student acquires a clear understanding and working knowledge of engineering mechanics, static forces, masses moving with constrained motion, and velocity and acceleration, which must be studied in relation to each other as applied to machine elements.

2. A machine design laboratory where the student learns by demonstration the importance of machine design and the effects of properties of materials, types of loading, and existing stress distribution on the design of machine parts. The equipment consists of photoelastic apparatus, vibration table, and demonstration apparatus which are used to aid the student in visualizing the various phenomena encountered in machine parts under simulated operating conditions.

3. A model room which contains actual machine parts, assembled mechanisms, and working models that are discussed and designed in the classroom. These exhibits enable the student to understand and appreciate the derived equations, design procedures, and experience factors used in machine design work.

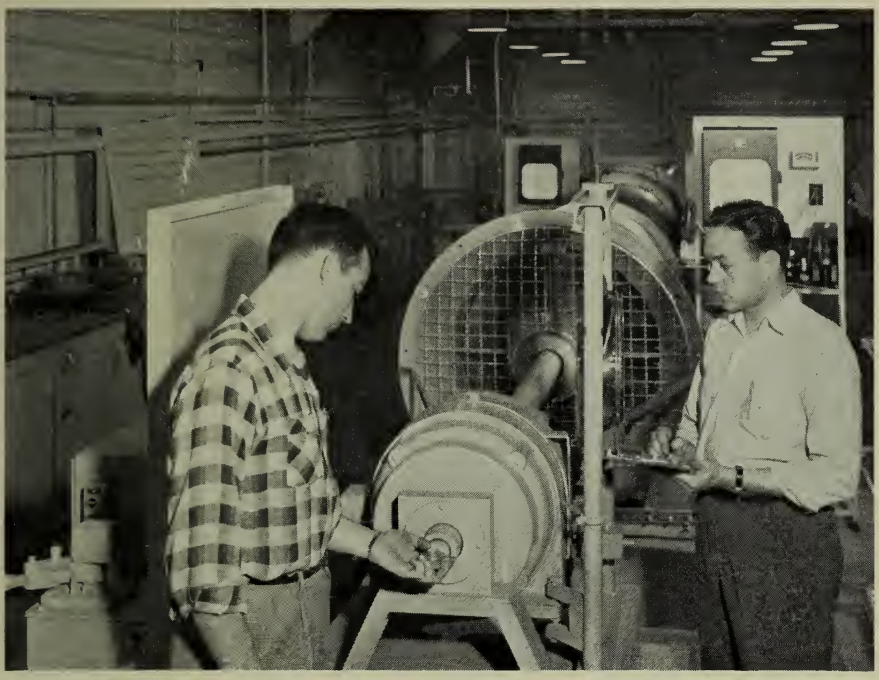
Certain phases of mechanical engineering, although closely associated with heat treatment of metals, metal processing, internal combustion engines, and steam power equipment, are of such importance that studies should be made upon them individually rather than as a part of a large piece of equipment. Special laboratories in the fields of instruments and controls, fuels and lubricants, heat transfer, and thermodynamics are provided for this purpose.

MINING AND METALLURGICAL ENGINEERING

The classrooms and office of the Department of Mining and Metallurgical Engineering are in the Ceramics Building. The laboratories are located partly in the Mining Laboratory, which adjoins the west end of the Kiln Laboratory, and partly in the Metallurgical Laboratory, which in turn adjoins the Mining Laboratory.

Sampling and Grinding Laboratory. Complete field and laboratory equipment is available for sampling and for the reduction of samples. The grinding room is equipped with a jaw crusher, coal grinders and pulverizers, disc-type pulverizing mills, sieve-test apparatus, a sample mixer, etc.

Chemical and Physical Laboratory. This section of the Metallurgical Laboratory is used for control of various coal-utilization and ore-dressing tests. Chemical equipment is available for all types of analytical work. It includes complete equipment for the proximate or ultimate analysis



Blower and fan of a mine ventilator

of coal, fusibility of ash, and the calorific value of coal. Special apparatus includes a gas calorimeter, a sulfur turbidimeter, a calorimetric pH comparator, combustion trains, and specific gravity apparatus for solids, liquids, and gases. Petrographic and mineral-dressing microscopes are available for studying special coal and ore problems. Adjoining this laboratory is a well-equipped balance room.

Coal Preparation and Ore Dressing Laboratory. A large part of the equipment in the main laboratory is special apparatus for the testing of coal. Equipment is available for float-and-sink tests for any size of sample and any size of coal.

Apparatus or machinery of special application to coal preparation problems includes coal crushers and pulverizers, vibrating screens, wet concentrating tables, jigs, a sand-flotation unit, a centrifugal dryer, and filters. A briquetting press is also available for the making of coal briquets.

Special equipment for ore-dressing problems consists of coarse rock breakers; rolls; pebble, ball, and rod mills; hydraulic and mechanical classifiers; a magnetic separator; froth flotation units; and a large drying oven.

Ventilation Laboratory. This laboratory is equipped with the most modern types of both centrifugal and axial flow fans for study of their operation characteristics and application to mine ventilation. Model mine ducts and scientific air flow and pressure measurement instruments are employed to study air flow. Gas analysis apparatus, flame safety lamps, gas detectors, and similar devices are available for both study and research. A variety of anemometers, hygrometers, and thermometers (such as the Kata thermometer) are among the instruments used for study of properties of mine air. For close control of fan tests a recording barometer and a recording pressure gauge are employed. This equipment is used for both undergraduate and graduate study.

Drilling and Blasting Laboratory. Representative drilling machinery and accessories consist of hand and electric augers, rock drills of various types, a portable diamond drill, a gas-fired heating furnace for drill steel, and a compressed-air drill-sharpener. Dummy cartridges, squibs, fuses, electric detonators, tamping tools, blasting machines, circuit testers, and shot-firing equipment are also on hand.

Welding Laboratory. The equipment in this laboratory includes welding booths and a Lincoln electric arc welder, high-speed cutoff machines, surface grinder, fatigue machines for rotating beam and sheet specimens, Izod-Charpy tension impact machine, Riehle Universal 40,000-pound testing machine, Rockwell and Brinell hardness testing apparatus, rolling mill, and swager for working metals up to ½-inch diameter. Adjoining the laboratory is a specially equipped machine shop for the construction and maintenance of apparatus for instruction and research.

Electrometallurgical Laboratory. This laboratory is fully equipped for routine chemical experimentation and in addition has such equipment as voltmeters, ammeters, potentiometers, and accessory electrical equipment for instruction and experimental electrometallurgy.

Furnace and Heat Treatment Laboratory. Equipment for a great variety of melting and heat-treating operations is maintained in this area, including induction and arc melting furnaces, electric resistance hearth and salt-bath type furnaces, and gas-fired, controlled-atmosphere, vacuum, and forced-draft furnaces. Also available is such special apparatus as equipment for measuring the hardenability of steels, growing single crystals, and high-speed automatic recording of temperatures and presses for making powdered metal compacts.

Metallographic Laboratory. This laboratory includes a grinding room and fume hood, separated from the microscope room by a glass partition. Equipment is available for the complete preparation of specimens for metallographic examination; it includes carborundum grinders,

endless-belt grinding machines, wet-polishing wheels, metallographic microscopes, large work tables, and etching equipment. Adjoining rooms contain metallographs and a macrocamera, apparatus for levigating polishing compound, and completely equipped darkrooms for photographic work. All rooms are ventilated with tempered air.

Research Laboratories. These rooms are mainly reserved for staff and graduate research work. They contain special items of equipment such as metallographs, micro-hardness testers, electropolishing units, vacuum furnaces, and specially designed experimental testing equipment.

PHYSICS

The Physics Building houses the classrooms, undergraduate laboratories, a large lecture and demonstration hall, the library, and the office of the Department of Physics. Some graduate and research laboratories are also in the Physics Building, as are a machine shop for maintenance personnel, one for students and faculty, and a glass-working shop with the service of two expert glass blowers. Facilities for instructional purposes and research include gas, direct and alternating current at several voltages, compressed air, vacuum lines, liquid air, and distilled water. In addition to these services excellent equipment is also available for investigations in optical and mass spectroscopy.

General Physics Laboratories. Consisting of three large rooms in the northwest wing of the building, these laboratories are used for instruction in elementary physics courses. In these laboratories all engineering students learn the basic principles of physical measurement and experimentation. Conducting approximately 30 experiments in a year, the student is challenged by the quality of the instruments and equipment to achieve high standards of precise measurement.

Advanced Undergraduate and Graduate Laboratories. One laboratory is well equipped for electrical and magnetic measurements (including work in vacuum tube circuits), another for work in light and spectroscopy, and a third for a variety of experiments in modern research methods and techniques. A laboratory is also provided for work in biophysics. Since the equipment in these laboratories is of research quality, the student is encouraged to approach the experiments as research problems.

Nuclear Radiations Laboratory. Located in a separate building, this laboratory contains radium sources amounting to 350 milligrams which furnish neutrons for investigation of their interaction on atomic nuclei.

Cyclotron Laboratory. The cyclotron is housed in a separate building adjoining the nuclear radiations laboratory. Capable of accelerating

deuterons to an energy of 10 million electron volts, the cyclotron is used to investigate the interaction of heavy particles with each other and atomic nuclei.

Betatron Laboratory. Located on the south campus, the new Physics Research Laboratory houses the present 20-million volt and 4-million volt betatrons. It also houses the recently completed 75-million volt machine which has served as a pilot model for the 400-million volt machine that is now being used for research. In addition to the betatrons and associated test apparatus for investigations into the effects of accelerated electrons on atomic and subatomic particles, the building also contains a large machine shop, a glass-working shop, an electronics shop, and facilities necessary for the maintenance and construction of the equipment.

THEORETICAL AND APPLIED MECHANICS

The Arthur Newell Talbot Laboratory houses the classrooms and most of the laboratories and offices of the Department of Theoretical and Applied Mechanics. In addition, some portions of the Civil Engineering Department are located in the building. Built in the form of an H, the building's two 50 by 187-foot four-story wings are joined by a 92 by 110-foot four-story stem. The departmental facilities may be divided into the following specifically designated areas, some of which are used only for research purposes but all of which are open to students.

Properties of Materials Laboratory. This laboratory, which occupies the entire second floor of the west wing of the building, is used mainly for undergraduate instruction. It contains ten testing machines capable of exerting forces up to 50,000 to 200,000 pounds on members or specimens loaded in tension, compression or as beams, as well as a considerable number and a great variety of smaller hand- and motor-driven machines for loading and studying columns, beams, and shafts. There also are machines for measuring hardness and for determining the effects of repeating the load many times and of applying the load suddenly.

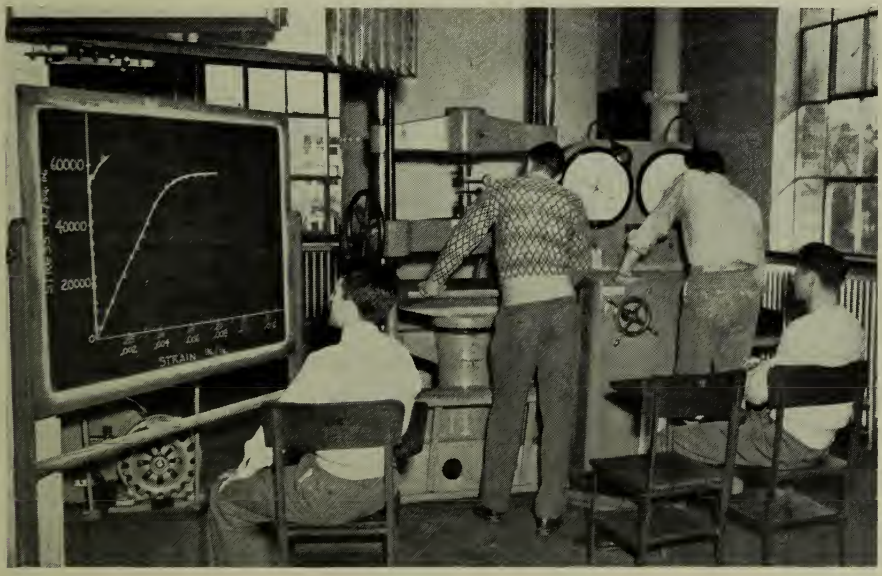
Hydraulics and Fluid Mechanics Laboratory. This laboratory occupies the basement and the first floor of the west wing and is used for student experiments as well as for investigating engineering problems in hydraulics and fluid mechanics. Water is supplied to the equipment from a standpipe 6 feet in diameter and 65 feet high, which, in turn, is fed by five centrifugal pumps which take water from a sump located below the basement floor level. When larger quantities of water are needed, a centrifugal pump can furnish 13,500 gallons per minute at a head of 35 feet; a special channel is available to handle the large flow from this pump. In this laboratory also are weirs, orifice tanks, glass-walled tilting flumes, meter-testing equipment, venturi meters for measuring

flow, centrifugal pumps, hydraulic ram, turbines, cavitation unit, viscometers, and apparatus for demonstrating turbulent and laminar flow.

Fatigue of Metals Laboratory. A laboratory occupying half the third floor of the west wing is used primarily for graduate instruction and research studies of the behavior of metals under loads applied and released a large number of times, which is commonly called fatigue. This laboratory is unusually well equipped, containing many repeated-load testing machines of various types and sizes. The laboratory also contains equipment for making repeated-load studies at elevated temperatures and under corrosive conditions.

Plastics Laboratory. For the study of plastics a laboratory is equipped with complete temperature and humidity control and contains machines and equipment especially designed to investigate the behavior of plastics and laminated materials when subjected to loads. The effects of time and temperature on load resistance are determined from studies involving, at different temperatures, various load conditions such as repeated, impact, short-time, and long-time or creep. Some of the equipment can also be used for similar studies of metals.

Large Crane Bay. This room, 40 feet wide by 147 feet long, occupies the central portion of Talbot Laboratory from the basement to its full height. It is served by a ten-ton crane 50 feet above the floor. Here are located the large capacity testing machines used to study the load-



An aluminum alloy is loaded in tension and its elongation measured

carrying and deformational behavior of large structural and machine parts such as full-size concrete footings, concrete bridge slabs, concrete frames and columns, and railroad rails. The laboratory contains an Emery-Tatnall testing machine of 3,000,000-pound capacity with an electric elevator, a 600,000-pound capacity Riehle testing machine, machines for studying concrete under repeated loads, and a number of other large machines for making tests in bending, tension, compression, torsion, and impact. A special feature is the heavily reinforced concrete floor, 16 inches thick. The use of this area is shared with the Department of Civil Engineering.

Small Crane Bay. Adjacent to the large crane bay and connected to it is a two-story bay, 23 feet by 112 feet. It has a large door opening on a driveway so that large trucks can enter directly into the building. A six-ton traveling crane, a 300,000 pound testing machine, and other equipment is located here and, as in the large crane bay, a portion of the floor is of heavily reinforced concrete.

Concrete Laboratory. This research laboratory adjoins the small crane bay and occupies the basement and a portion of the first floor of the southeast wing of the building. It has storage space for concrete materials and contains equipment for making plain and reinforced concrete. This equipment includes concrete mixers, a concrete saw, vibrators, drying ovens, and a refrigerating unit. A large moist room with temperature control provides standard curing conditions for test pieces. The laboratory contains the various types of machines needed for testing cement, sand, aggregates, and mortar.

Car Wheel and Brake Shoe Laboratory. Situated in a separate building, this laboratory contains a machine for testing railway car wheels and brake shoes. The machine is capable of exerting a shoe pressure of 22,000 pounds and operating at equivalent train speeds up to 100 miles per hour. It is fully equipped for the determination of the stresses, temperatures, and structural phenomena developed in the rotating wheel by brake application and for the study of the performance of brake shoes.

Miscellaneous Laboratories. Several other laboratories are equipped for special work, such as the continued deformation of materials under loads sustained for a long period of time, called creep; the production and measurement of vibrations by mechanical and electronic equipment; the effect on railroad rails of rolling loads simulating locomotive wheel loads; the determination of stresses in transparent models of machines and structural members by means of polarized light; and the photographic study by means of a movie camera of the flow of water in transparent models under various conditions of flow.

Machine Shop. In this large, well-equipped shop the specimens and apparatus for student use are made, as well as much of the special equipment which is needed for the research investigations carried on in the various laboratories.

THE COLLEGE OFFICES

The offices of the Dean (who is also the Director of the Engineering Experiment Station), the Associate Director, the Associate Dean, the Assistant Dean, and the Director of Engineering Information and Publications are on the first floor of Civil Engineering Hall, as is a conference room for College and Station committee meetings.

THE ENGINEERING LIBRARY

The Engineering Library plays an important part in the teaching and in the research activities of the College of Engineering. Learning to know the Engineering Library, its collection and how to use it, should be an early aim of every student, for it will be of value to him not only in his student days but in the years ahead when he is engaged in engineering work, in teaching, or in research. The field of technical knowledge is so wide in scope that only a small part of the material can be covered in class instruction; this must be supplemented by technical literature. The Engineering Library is a vast storehouse of such information.

The library contains approximately 65,000 volumes including books, bound volumes of periodicals, publications of engineering societies, and most of the important engineering publications issued by state, federal, and foreign governments. Over 650 technical journals are received.

The library has an excellent collection of general technical dictionaries in foreign languages with English definitions, as well as similar dictionaries in special fields of engineering.

It has a good collection of biographies of engineers and of early books on engineering.

Its collection of current books is strong in all fields of engineering such as aeronautics, electronics, fluid mechanics, graphical expression, heating and ventilating, highway transportation, hydraulics, illumination, machine design, mechanics, metallurgy, mining, power generation and distribution, railways, sanitary engineering, strength of materials, structures, thermodynamics, and vibrations.

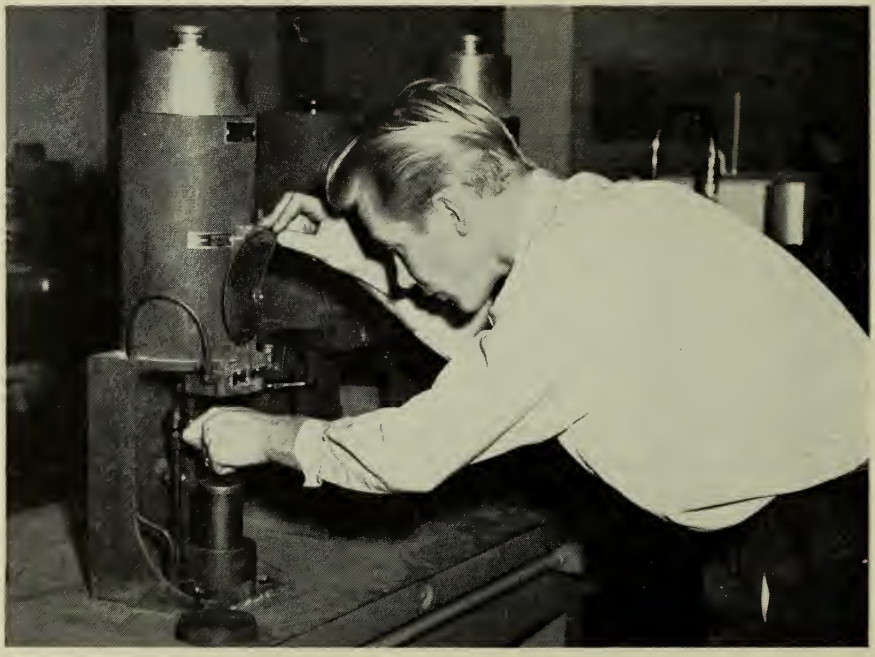
The library also contains books for general reading, including popular works in science, engineering fiction, and publications on vocational guidance pertaining to engineering. Important books and sets on engineering in English and in foreign languages are added to the collection

each year, and since World War II numerous reports have been received from research laboratories in this and other countries.

In addition to the publications on engineering in the College library there are extensive collections of related materials elsewhere on the campus. Notable are those in ceramics and ceramic engineering, chemistry, mathematics, and physics and the 55,000 volumes on engineering housed in the General Library.

To aid users, the Engineering Library has complete sets of important indexes to periodical literature such as the *Engineering Index,* the *Industrial Arts Index,* and indexes to sets of individual engineering magazines, to publications of engineering societies, and to other series. It has complete sets of the more important abstracting services such as *Chemical Abstracts* and *Science Abstracts,* and of the digests covering the literature of many of the divisions and subdivisions of the fields of engineering. Other bibliographical aids are also available to users of the library.

The Engineering Library provides two reading rooms on the first and second floors of the central wing of Civil Engineering Hall. During the



Learning the principles of quality control of raw materials through actual industrial tests in the Cast Metals laboratory at the Chicago Undergraduate Division

periods classes are in session the library is open continuously mornings, afternoons and evenings, and at all times trained librarians are ready to assist students in their use of the collection.

CHICAGO UNDERGRADUATE DIVISION

The Chicago Undergraduate Division provides facilities for at least the first two years of engineering (and other) studies for students who find it necessary or desirable to live in the Chicago area during the first portion of their attendance at the University of Illinois. Except for a few courses in agricultural, ceramic, metallurgical, and mining engineering, the two-year program is identical with that offered at the Urbana-Champaign campus.

Public transportation facilities are excellent from all parts of Chicago and the surrounding area.

The Chicago Undergraduate Division occupies a portion of Navy Pier. It has 62 classrooms; 7 large lecture halls; 33 modern, fully equipped laboratories in chemistry, biological sciences, physics, and statistics; a welding laboratory, foundry, testing laboratory, and machine shop; 3 architecture drafting rooms; and 8 engineering drawing laboratories.

The library consists of more than 55,000 volumes. Spacious and well laid out, it provides excellent study and reference facilities.

Among its resources are a complete dictionary catalog, subscriptions to 600 magazines and journals, 30 periodical indexing services, a large vertical-file pamphlet collection, and excellent microfilm reading facilities.

Ample headquarters are provided for such officials as the Dean of Students, Dean of Men, Dean of Women, Associate and Assistant Deans of Engineering Sciences, and the personnel of the Student Counseling Bureau.

A University bookstore is operated on a cooperative basis to provide texts and supplies as required by the various academic courses.

A food service, attractive lounges, and a large gymnasium adjacent to the Pier are among other features of the physical facilities.

Those interested in a more complete description should write for the Catalog of the University of Illinois Chicago Undergraduate Division.

VI. REQUIREMENTS FOR ADMISSION

Entrance requirements vary somewhat among engineering colleges of the country. Basically, they emphasize preparation in English, mathematics, and the physical sciences. This core of essential subject matter should be supplemented by substantial preparation in social studies, natural sciences, and languages. Some work in manual arts is highly desirable. The entrance requirements, which include high school graduation, must total at least fifteen units.

Four of these units must be in mathematics if the student is to be admitted to full freshman status.* In addition, the requirements include three units of English, and two units in social studies, or natural sciences, or foreign languages. Preferably these two units should be in the physical sciences (chemistry and physics). The remaining six units of the fifteen offered for entrance may be from any subjects the high school accepts towards its diploma.

Methods of meeting the mathematics entrance requirements are numerous. Students may be admitted to full standing in the College of Engineering by offering the following credits and passing a placement examination in mathematics.

Algebra	2 units
Plane Geometry	1 unit
Solid Geometry	½ unit
Trigonometry	½ unit

The placement examination in mathematics is given in June, September, and February.

Admission by Passage of Placement Examination. As an alternative to the procedure named above, students who do not submit four units in the specified subjects but who meet all other requirements may be admitted to full standing by passing a placement examination which will indicate that their preparation is adequate for entrance to analytic geometry. This examination will assess the students' understanding of

* For admission to full status in the Chemical Engineering curriculum, solid geometry is not required. However (see footnote 3, page 98), two units of a foreign language are required, except that the Director of Admissions may waive this latter requirement for students in the upper half of their high school class.

the topics labeled as indispensable in the list on pages 12–14 of *Mathematical Needs of Prospective Students,* previously referred to.

Some high schools offer all the mathematics courses required for admission to the College of Engineering. Students in these schools should have no difficulty in being admitted to full standing in the College provided they plan their high school programs carefully in advance.

Students who have not had all the mathematics stipulated may gain admission to the College of Engineering in three ways:

1. Provided that they satisfy the other admission requirements and have a minimum of one unit of algebra and one unit of plane geometry, students may be admitted with a deficiency in mathematics. They must remove this deficiency in their first year in college by passing courses in the subjects in which they are deficient. Students admitted under this provision cannot expect to complete the requirements for the bachelor's degree in engineering in eight semesters. It is recommended that such students enter the University in the summer session following their graduation from high school.

2. They may study by themselves the subjects they have not taken in high school and many prepare for (a) a general placement examination in mathematics covering the list of topics already cited or (b) proficiency examinations in the individual mathematical subjects.

3. Provided that they have had one unit of algebra and one unit of plane geometry, they may enroll in correspondence courses offered by the Extension Division of the University of Illinois.* These courses, if successfully completed, will be accepted by the College of Engineering of the University of Illinois for credit for admission in the same manner as if they had been completed as part of the high school program of studies. Successful completion of the correspondence courses offered by other colleges and universities is equally acceptable, provided that these courses are taken from accredited institutions. Before enrolling in such courses, students should check first with the Director of Admissions of the University of Illinois to find whether the courses are acceptable.

Excepting the fixed stated units in English and mathematics, modifications of the foregoing requirements for admission may be made in the case of students graduating in the upper half of their high school classes. These should be discussed with the Director of Admissions of the University, through whose office all admissions to the various colleges are made. Nonresidents of the state of Illinois may not be admitted if they are high school graduates in the lowest quartile of their class.

* See the University of Illinois Bulletin "Correspondence Courses" for a description of course offerings, regulations, and procedures for admission.

VII. FINANCIAL INFORMATION

FEES

Estimated expenses for undergraduate students, exclusive of such variable items as clothing, railroad fare, and recreation, are given in the budgets below. These budgets cover two semesters for students who are residents of Illinois. For those who are not residents of Illinois the tuition is higher.

	Minimum	*Moderate*
Tuition and fees	$146	$146
Textbooks	40	50
Other school supplies	15	24
Room and board (figured for nine months)	585	720
Laundry (mailed home)	20	20
Miscellaneous	94	120
Total, Two Semesters	$900	$1080

Tuition and Fees in Undergraduate Colleges and Schools

(Payable in full when the student registers)

Tuition Fee.

All students who are residents of Illinois, except those holding scholarships, pay each semester a tuition fee of ..... $ 50.00

All students who are not residents of Illinois, pay each semester a tuition fee of 160.00

Hospital and Medical Service Fee. All students, including persons on part-time appointment on the University staff or the staffs of the allied surveys or laboratories, except students taking not more than one unit of graduate work or five hours of undergraduate work in a semester, or one-half unit of graduate work or three hours of undergraduate work in the eight-week summer session, pay each semester, as insurance for hospital and medical service, a fee of 5.00

(Note: A student who presents evidence of participation in any other group insurance system providing the same benefits as those covered by the University fee, may petition through the office of the Dean of Students for a refund of this fee.)

Laboratory, Library, and Supply Fee. Students taking more than eight hours of instruction, pay each semester a laboratory, library, and supply fee of 11.00

(Students taking less than this amount of instruction pay $5.50 each semester.)

Late Registration Fee. Former students who register after the regular registration days in either semester pay a late registration fee of 5.00

Change Fee. For every change slip issued later than the Saturday following registration, the fee is 1.00

Listener's Fee. Persons not connected with the University who attend classes as listeners pay for each course each semester 7.50

Transcript Fee. Each student who has paid all his University fees is entitled to receive, without charge, one transcript of his record. For each additional transcript the fee is ..... .50

Special Examination Fee. For any special examination to remove a failure the fee is 5.00

Illini Union Service Charge. All students registering for resident work in the Urbana departments of the University, except graduate students who are members of the University staff and others who are registered for not more than one unit of graduate work or not more than five semester hours of undergraduate work, are assessed each semester an Illini Union service charge of..... 7.00

Activities Service Fee. All students in the Undergraduate Division at Chicago, except those who are registered for not more than five semester hours, pay each semester a student activities service fee of..... 6.00

Fee for Instruction in University High School. University students at Urbana who also register in the University High School pay, in addition to their University fees, for each half-unit each semester..... 10.00
(Provided that the total additional charges shall not exceed $25 a semester.)

Flight-Training Fee. Students taking flight-training courses in the Institute of Aviation pay each semester a materials and supply fee of..... 250.00

Identification Card. Each student on completing registration in each semester is given an identification card for use in obtaining loans of library books, locks, towels, and other equipment.

Service Charge for Deferred Fees. A service charge of 10 per cent of the amount of fees deferred, but not to exceed $3 a semester, is assessed for the privilege of deferring fees, and this charge must be paid on the day of registration. If deferred fees are paid in full within ten days after registration, the service charge is refunded *except* that a minimum service charge of $1 is retained by the University in all cases. The service charge and all charges from previous semesters must be paid on the day of registration.

Refunds of Fees. In case a student withdraws from a course or from the University during the first ten days of instruction, the total amount of his fees for the work dropped will be refunded. After ten days and before the middle of the semester, a rebate of one-half the fees will be made. After the middle of the semester, no rebate will be allowed. In the summer term, for students registered for eight weeks, the total amount of fees paid will be refunded if withdrawal occurs within the first five days; one-half the amount after the first five days but within the first four weeks; and nothing after the beginning of the fifth week.

Summer Session Fees

Students registered in the eight-week summer session pay fees as listed on page 74 except that the tuition fee for residents of Illinois is $25; and for nonresidents, $80; laboratory, library, and supply fee, $5.50; hospital and medical service fee, $2.50; Illini Union service charge (Urbana only), $3.50; activities service fee (Chicago Undergraduate Division only), $3.

Students registering for the Summer Camp for Surveying Instruction pay a tuition fee of $25 if residents of Illinois, or $80 if nonresidents of Illinois; laboratory, library, and supply fee, $5.50; and hospital and medical service fee, $2.50.

Fees for Part-Time Students

Undergraduates registering for reduced schedules pay, instead of the regular tuition fee, $4 per credit hour if a resident of Illinois, or $11 per credit hour if not a resident of Illinois; provided registration is for not more than eight credit hours in one semester or four hours in eight-week summer courses.

SCHOLARSHIPS

Unless otherwise stated, an undergraduate scholarship covers the tuition fee in any department of the University. For more detailed information, apply to the Director of Admissions and Records.

Air Foundation Scholarships. Through a gift from the Air Foundation of Cleveland, four scholarships of $250 each are awarded to students in aeronautical engineering to cover the fee for a one-semester course in flight training. Awards are made on recommendation of the Department of Aeronautical Engineering.

Alpha Phi Omega Scholarships. From funds given annually by Alpha Phi Omega fraternity, scholarships in varying amounts are awarded to students with superior scholarship records who need financial aid.

American Air Filter Company Scholarships. This company provides one $300 scholarship for a sophomore, one $300 scholarship for a junior, and one $400 scholarship for a senior in mechanical, electrical, or general engineering with a mechanical option, who are citizens of the United States and who have superior scholarship records. Selection is made by the American Air Filter Company on recommendation of the College of Engineering and the Committee on Special Undergraduate Scholarships.

Campus Chest, Woman's League, and Student Affairs Scholarships. The Campus Chest, the Woman's League, and the Committee on Student Affairs have made available funds from which annual scholarships of varying amounts are awarded.

Ceco Steel Products Corporation Scholarships. Two scholarships for juniors and two scholarships for seniors in civil or general engineering. Each scholarship is $500 a year. Awards are made by the Committee on Special Undergraduate Scholarships on recommendation of a Committee of the College of Engineering, one member of which shall be the Head of the Department of Civil Engineering.

Ceramic Scholarships. Ten four-year scholarships, covering the tuition fee, are available each year. These scholarships are financed by industry through the Ceramic Scholarship Trust Fund. Awards are made by the Committee on Special Undergraduate Scholarships. Recommendations of the Department of Ceramic Engineering are considered in selecting the candidates.

Scholarships for Children of Veterans of World War I and World War II. By act of the legislature (1947) one scholarship is available in each county in Illinois each year for a child of a veteran of World War I and one each year for a child of a veteran of World War II. This scholarship is awarded to the candidate who receives the highest grade in the competitive examination held on the first Saturday in June each year as described in the paragraph on County Scholarships below except that preference shall be given to children of veterans who are deceased or disabled. It exempts the holder from the tuition fees for four years in any department of the University. Proof of service of the war veteran and of his relationship to the candidate is required.

William J. Cook Fund Scholarships. A number of scholarships are available to young men who are graduates of Cook County high schools, under a bequest made by Mr. William J. Cook in 1940. Applications should be filed with the Chicago Community Trust, 10 South LaSalle Street, Chicago. High school seniors should apply not later than April 15; college students not later than May 15.

County Scholarships. One scholarship for each county in Illinois is created by statute, and sixty-six additional scholarships for Cook County have been established by the Board of Trustees. These are awarded by competitive examinations given on the first Saturday in June under the supervision of the County Superintendent of Schools. Candidates write on English (rhetoric) and on two of the following fields: mathematics, natural science, and social studies. A candidate who has had college work is not eligible.

Douglas Aircraft Company, Inc. Scholarship. One $600 scholarship is awarded to a senior in aeronautical, mechanical, or electrical (electronics) engineering. The award is made by the Committee on Special Undergraduate Scholarships on recommendation of the College of Engineering, subject to the approval of the Scholarship Board of the Douglas Aircraft Company, Inc.

Enzymatic Scholarship in Sanitary Engineering. Market Coverage, Inc. and N. O. Nelson Company provide two $500 scholarships for seniors in sanitary engineering. Awards are made by the Committee on Special Undergraduate Scholarships on recommendation of the faculty in sanitary engineering.

Foreign Students Scholarships. The Board of Trustees has established twenty-five scholarships each year, covering the tuition fee, for students from countries friendly to the United States. Applicants for these scholarships who are from the countries of South and Central America are selected through recommendation of the Institute of International Education. Other applicants should apply to the Director of Admissions and Records of the University, who serves as chairman of the committee which selects the candidates.

Forney Foundation Scholarships. Two $250 scholarships for male freshmen in agriculture or agricultural engineering who have demonstrated interest and skill in improving agricultural machinery and equipment have been established by the Forney Foundation of Fort Collins, Colorado. Awards are made by the Committee on Special Undergraduate Scholarships on recommendation of the Department of Agricultural Engineering and the scholarship committee of the college concerned. The applicant's previous work with agricultural machinery and his plans to continue agricultural work will be considered in selecting a candidate.

General Assembly Scholarships. Each member of the General Assembly may nominate annually one student from his district for a four-year scholarship which will exempt the holder from tuition in any department of the University.

General Undergraduate Scholarships. Scholarships are granted in varying amounts from this fund to undergraduate students. A portion of the fines paid by students for violations of University regulations and undesignated gifts for scholarships are deposited in this fund.

John M. and Louisa C. Gregory Scholarships. Scholarships of $100 each are available under the will of Mrs. Louisa C. Gregory, which provides that the applicants be "self-sustaining students free from the vices of smoking and chewing tobacco and from the use of intoxicating liquors." The scholarships are awarded to students who have been in residence at the University for at least one semester, on the basis of a competitive examination held in December in years when funds are adequate for at least two scholarships.

Dunlap Harrington Memorial Fund. Established in memory of Dunlap Harrington by his brother, this fund provides an award of $50 to a male senior in his final semester, who is financially unable to take part in the special events of that semester.

Harrison Jules Louis Frank and Leon Harrison Frank Memorial Corporation Scholarships. One $500 scholarship is provided each year for a junior, senior, or graduate student in the power engineering option in electrical engineering. The award is made by the Committee on Special Undergraduate Scholarships on recommendation of the department. Applicants must rank in the upper one-third of their class and must show evidence of financial need. The scholarship may be renewed but it may not be used more than two years by one person.

Holophane Company Illuminating Engineering Scholarships. Scholarships of $200 are awarded to two second semester juniors, two first semester and two second semester seniors in illumination engineering. The awards are based on scholarship, activities, and promise of success in this field. A candidate must be a citizen of the United States and must have completed at least one semester in the University of

Illinois. Awards are made by the Committee on Special Undergraduae Scholarships on recommendation of the teaching staff in illumination engineering.

Illini War Memorial Scholarships. Scholarships in varying amounts are made available by the University of Illinois Foundation from gifts to the Illini Achievement Fund.

Illuminating Engineering Scholarships. Two scholarships of $250 each per year are made available by a gift of the Illuminating Engineering Society (Chicago Section). One scholarship is awarded to a junior and one to a senior in the illuminating engineering option of electrical engineering. The awards are made by the Committee on Special Undergraduate Scholarships on the recommendation of the teaching staff in illuminating engineering. A candidate must be a citizen of the United States, must have completed one full semester in the University with a superior scholarship record, and must give promise of being successful in his chosen profession.

Latin Contest Scholarships. The winner of the annual Latin contest sponsored by the Illinois Classical Conference receives exemption from the tuition fee for one year.

Military Scholarships. Acts of the General Assembly passed in 1919 and 1943 provide scholarships for veterans of World War I and World War II who, at the time of enlistment, were residents of Illinois or students in the University of Illinois. These scholarships exempt the holders from the tuition fee in any department of the University.

Mining Engineering Scholarships. Funds have been received from various donors to provide scholarships for students in mining engineering. These scholarships are awarded by the Committee on Special Undergraduate Scholarships on the recommendation of the Department of Mining and Metallurgical Engineering. In certain instances, preference is given to employees or children of employees of the donor. These scholarships have a value of $200 a year. Funds have been received from the Illinois Mining Institute, Old Ben Coal Corporation, Peabody Coal Company, Sahara Coal Company and Henry A. Petter Supply Company. Sahara Coal Company scholarships are also available for graduate study in mining engineering.

Morava Scholarships. These scholarships are made available under the will of Wensel Morava. They are awarded annually in varying amounts.

John Morse Memorial Scholarships in Engineering. Three scholarships for juniors and three for seniors are awarded from funds given by the John Morse Memorial Foundation. Each scholarship is $500 a year. First preference is given to students in mechanical engineering and second preference to students in electrical engineering. Awards are made by the Trustees of the Foundation on recommendation of the College of Engineering and the Committee on Special Undergraduate Scholarships.

La Verne Noyes Scholarships. Made available under the will of La Verne Noyes, these scholarships cover part of student fees for one year. They are open to students who served in the Army or Navy of the United States of America in World War I, or to descendants of active participants in that war.

Alfred E. Pickard Scholarship in Engineering. This scholarship, worth $200, is awarded to a worthy student in the College of Engineering, preferably a student in mining engineering, who needs financial aid. The award is made by the Committee on Special Undergraduate Scholarships on recommendation of the Department of Mining and Metallurgical Engineering.

John C. Ruettinger Memorial Scholarship Fund. This scholarship was established by Mr. John W. Ruettinger, of Chicago, an alumnus of the University of the class of 1927, in memory of his father. It provides annually tuition and other educational expenses for one or more worthy and needy undergraduate students.

Phyllis Pierce Ruettinger Scholarship. This scholarship was established in memory of Phyllis Pierce Ruettinger by her mother. Awards are made annually to junior or senior women registered at the University of Illinois, on the basis of character, scholarship, general ability, and financial need.

John T. Rusher Scholarship Fund. Floyd E. Rusher and Dorette J. Rusher of Peoria, Illinois, have established a trust fund in memory of their son, John T. Rusher, who died while in the service of his country. The income from this fund is used for scholarships. Awards are made on the basis of scholastic promise, character, and financial need. Other qualifications being equal, preference is given to students from Peoria or Tazewell County.

Frederick D. Secor Memorial Scholarships in Electrical Engineering. A bequest in the will of the late Bessie Secor, in memory of her father, provides scholarships for students in electrical engineering.

Square D. Scholarship. The Square D. Company has established a scholarship of $350 for a junior in electrical, mechanical, industrial, or general engineering. Scholarship, integrity, personality, leadership ability, and financial need are considered in selecting candidates. Final selection shall be made by the Company on recommendation of the College of Engineering and the Committee on Special Undergraduate Scholarships.

Linsley F. Ter Bush Memorial Scholarship Fund. The income from this fund, established by a bequest in the will of the late Mrs. Louise M. Leopold, is used for scholarships.

University and Science Talent Scholarships. The Board of Trustees has established for each year twelve scholarships open to residents of Illinois and known as University Scholarships. Two of these scholarships are designated for students recommended by the Illinois State Academy of Science. These University Scholarships exempt holders from the tuition fees as required in those colleges of the University which admit students directly from high schools. A scholarship may be lapsed or forfeited if the holder fails to maintain a satisfactory record, is dismissed by the University authorities, or ceases to be a resident of Illinois.

LOAN FUNDS

The following loan funds have been established for the benefit of worthy students of the University who are in need of financial aid. Loans are not ordinarily made to students during their first year at the University. Each application must be approved by the Dean, Director, or Assistant Dean of the college or school in which the student is registered, by the Dean of Students, the Dean of Men, or the Dean of Women, and by the Comptroller; in case of disagreement among these officers the application will be submitted to the Chairman of the Finance Committee of the Board of Trustees. Security in the form of a qualified endorser or collateral satisfactory to the Comptroller is required for all long-term loans unless otherwise provided in the deed of gift of the fund or waived in meritorious cases, as determined by the Dean of Men or the Dean of Women and the Comptroller. Application blanks may be obtained from the offices of the Bursar, the Dean of Men, and the Dean of Women.

Dora E. Biddle Loan Fund for Girls. This fund was derived in 1919-1920 from two gifts by Mrs. Dora E. Biddle of Macon, Illinois. Preference is given those women students most advanced in their University work.

Carter-Pennell Loan Fund. Donated by the late Joseph Carter and his wife, Jane Pennell Carter, in 1923. Loans may be made to any student of sophomore standing in the Colleges of Engineering and Agriculture, or to any student in the College of Liberal Arts and Sciences who is specializing in science.

Champaign Business and Professional Women's Club Loan Fund. Presented to the University on October 8, 1940. Loans from this fund are made to deserving women students.

Chicago Illinae Club Fund. Established by the Chicago Illinae Club especially for women students of the University.

Raymond Clamage Memorial Fund. Presented August 5, 1947, by Mr. and Mrs. Edward Clamage as a memorial to their son, Lieutenant Raymond Clamage. Loans may be made only to students on the *Daily Illini* staff.

Class of 1907 Loan Fund. Presented to the University on June 11, 1932, this fund is used for the making of loans to students under general rules of the Board of Trustees governing loan funds, with no restrictions except that preference be shown to lineal descendants of members of the class.

Consolidated Loan Fund. This fund results from the merger of the Automobile Show Fund, the Class of 1895 Loan Fund, the Graduate Club Loan Fund, and the Student Friendship Fund.

Grace Darling Memorial Fund. Founded by Mrs. R. V. Cram, of Minneapolis, in 1922. Operated under the regulations of the Edward Snyder Fund described below.

Louis Edward Dawson Memorial Fund. A gift from Mrs. Edward Dawson, accepted November 23, 1945, as a memorial to her son, Louis Edward Dawson. The fund is for aiding worthy students in chemistry.

Denison Memorial Fund for Worthy Seniors. The late Charles A. Denison, of Argenta, bequeathed this fund to be used for loans to worthy senior students on recommendation of the President and Treasurer of the University.

Detroit Illinae Club Loan Fund. Established May 11, 1932, as a gift from the Detroit Illinae Club.

Harry J. Diffenbaugh Trust Fund. The late Harry J. Diffenbaugh, of the Class of 1882, established a trust fund, the income of which is used for loans to worthy and needy students who are residents of the state of Missouri attending the University of Illinois. Applications for loans may be made to the Dean of Men of the University of Illinois or to the First National Bank of Kansas City, Missouri, the administrators of the trust fund.

Electrical Engineering Loan Fund. Established by the Electrical Engineering Society and maintained by the Student Branch of the American Institute of Electrical Engineers, this fund includes income from the electrical shows and is available for juniors and seniors in good standing in the curricula in electrical engineering and engineering physics.

Engineering Student Loan Fund. The residual assets of the Real Co-operative Company (formerly the Engineering Co-operative Society) were accepted by the University in 1936 for the purpose of establishing a loan fund for the benefit of students in the College of Engineering.

Margaret Lange James Student Loan Fund. Established by a gift from President E. J. James in 1914 and increased by the University Senate as a memorial to him. Loans may be made to students, preferably women, who have been in residence at least one year, have attained junior standing, and expect to graduate.

A. F. Kaeser Student Loan Fund. A gift from Dr. A. F. Kaeser, of Highland, Illinois, accepted on September 30, 1939, by the Board of Trustees. Graduates of high schools located in Highland, Illinois, are to be given preferential consideration for loans from this fund. If this loan fund is not exhausted through loans made to

these graduates, loans may be made to graduates of high schools located in the counties of Madison, Bond, and Clinton. Loans made to any one student shall not exceed $200 annually or $800 for the four-year period.

Willis Prentice Kimble Loan Fund. A memorial fund established by Mrs. Kimble in 1929. Loans may be made to sophomores, juniors, and seniors, but not in excess of $100 to any one individual.

Eddy Orland Lee Fund. This fund, a bequest of the late Jennie C. Lee as a memorial to her husband, was received by the University in 1952. Loans are made to deserving students to assist them in obtaining their education.

William E. Levis Loan Fund. Established in 1936 by a gift from William E. Levis of the Class of 1913, President of the Owens-Illinois Glass Company. Loans will be made (1) to employees or children of employees of the Owens-Illinois Glass Company and its affiliated companies or subsidiaries, who are students in attendance or prospective students expecting to register immediately at the University; and (2) if funds are available, to students who have been in attendance at the University for at least one year, under the general regulations governing loan funds.

William B. McKinley Loan Fund. This fund is made up of several donations from the late Senator William B. McKinley, the gifts having been made between 1912 and 1926. Loans may be made to male students who have been in residence at least one year and intend to graduate.

J. R. Morris Loan Fund. Donated by the late Joseph R. Morris, of Anne Arundel County, Maryland, in 1922. Loans are made to students who have been in residence at least one semester. Preference is given to students who are advanced in University work.

Loan Fund for Overseas Soldiers. Originally donated in 1919, with an addition in 1924, this fund is available to soldiers, sailors, and marines with overseas service, and to their descendants. Qualifying students in the junior, senior, or postgraduate years are eligible, or students in any year in the College of Agriculture.

C. W. Parmelee Fund. Presented March 11, 1948, by friends of Professor Cullen W. Parmelee, for loans to students in ceramic engineering.

William T. Rogers Loan Fund. Established April 10, 1948, by bequest of William T. Rogers, for loans to deserving students in need of financial assistance.

Marcus Russell Loan Fund. Donated by the late Marcus Russell, of Los Angeles, California, in 1926, "The proceeds from this fund shall be used as a fund to be loaned to worthy and indigent students."

Edward Snyder Fund. This fund was established in 1899 by the late Edward Snyder, Professor of German in the University. Loans may be made to students of junior standing who are in residence and expect to graduate. Preference is given to those of high rank and advanced standing, but no distinction is made as to sex or course of study.

Henry Strong Educational Foundation. The Henry Strong Educational Foundation, established at Chicago under the will of General Henry Strong, provides for loans to students under the age of twenty-five years, preferably in the upper classes.

St. Louis Illinae Club Loan Fund. Established March 29, 1937, as a scholarship loan fund.

Woman's League Fund. Established by the Woman's League in 1911. This fund is administered under the regulations of the Edward Snyder Fund.

Emergency Loan Funds

Emergency loan funds are available in small amounts for short periods only. In the Urbana departments the approval of the Dean of Men or Dean of Women and the Comptroller is required. In the Chicago Undergraduate Division, the approval of the Dean of Students is required.

Cora C. Bright Memorial Loan Fund. A gift from the Illinois Congress of Parents and Teachers in 1939, for emergency loans to students at Urbana.

Class of 1932 Fund. Presented to the University on June 15, 1934, through the Alumni Association, for emergency loans to students at Urbana.

Verne Hall Detweiler Loan Fund. A gift from the Illinois Congress of Parents and Teachers in 1936, for emergency loans to students at Urbana.

Edward C. Heidrich, Jr., Loan Fund. Established in 1944 by a gift from Edward C. Heidrich, Jr., this fund is for emergency loans to students at Urbana.

Thomas L. Seanor Memorial Fund. This fund was presented November 1, 1945, by Lieutenant Harry F. Seanor as a memorial to his brother, Lieutenant Thomas L. Seanor.

Irene Symonds Loan Fund. A gift from the Illinois Congress of Parents and Teachers, accepted November 8, 1943, as a memorial to Irene Symonds. The fund is for emergency loans to students at Urbana.

Tau Delta Tau Loan Fund. This fund was presented November 1, 1945, by Tau Delta Tau fraternity as a memorial to two of its members, John Donald Danielson and Joel Hubbard Rossiter.

University Faculty Emergency Loan Funds for Students. Established in 1932-1933, these funds represent a portion of the money set aside for emergency loans to students at Urbana from funds solicited in 1931 by the University Senate Committee on Unemployment and Relief.

AWARDS

Competitive prizes, scholarships, fellowships, and miscellaneous awards, which are offered to students in the University, are classified here as follows: (1) those authorized by the Board of Trustees; (2) those awarded by local organizations; and (3) those not limited to students at the University of Illinois, but offered at other schools as well. The following lists are subdivided according to the agency authorizing or making the award, and the scope of the competition.

Prizes Authorized by the Board of Trustees

General Competitions

Bryan Prize. In 1898 Mr. William Jennings Bryan gave to the University the sum of $250, from the interest on which a prize of $50 is offered for the best essay on a topic relating to the science of government. The contest is open to all undergraduate students. The essays may not be less than 3,000 nor more than 6,000 words in length, and they must be left at the office of the Department of Political Science not later than the second Wednesday in May. It is suggested that the essays be on some phase of American government and that contestants confer with the Department of Political Science as to the selection of a topic. The prize is ordinarily offered every fifth year. It will be offered next in 1954.

English Poetry Prize. The Department of English offers a prize of $25 for the best undergraduate poem or group of poems of the year. The award may be withheld in any year if no entry is found worthy of a prize.

Thacher Howland Guild Memorial Prize. The Department of English offers a prize of $25 for the best undergraduate play of the year. The award may be withheld in any year if no production is found worthy of a prize.

Thrift Essay Prize. The income from a fund established in 1918 by the committee for the sale of War Savings Stamps in Illinois is available for prizes for

essays on thrift. Any student in the University who has had a course in the principles of economics is eligible to compete. The essays deal with some aspect of thrift, as designated by the Chairman of the Department of Economics, who is in charge of the contest.

College of Engineering

Ira O. Baker Prizes. The late Dr. Ira O. Baker, Professor of Civil Engineering, *Emeritus,* endowed two prizes for the two ranking senior students in civil engineering. These prizes, amounting to $75 and $25, respectively, are awarded primarily on excellence of scholarship and secondarily on personal qualities and professional activity. The names of the winners in each year are placed on a bronze tablet located near the office of the Department of Civil Engineering, and a special certificate is given to each winner.

Prizes Awarded by Organizations at the University

General Competitions

Alpha Lambda Delta Prize. The national organization of Alpha Lambda Delta, honorary society for freshman women, offers annually a book to the senior woman who in her freshman year was elected to Alpha Lambda Delta and who has maintained the highest scholastic average of the Alpha Lambda Delta graduating seniors.

Chi Omega Prize. The University of Illinois Chapter of Chi Omega offers annually a prize of $25 to the senior woman who has consistently done the most outstanding work in the field of sociology.

Thomas Arkle Clark Prize. The freshman honorary society, Phi Eta Sigma, gives each year a prize of $25 to the sophomore member of Phi Eta Sigma who has attained the highest scholastic average for his first three semesters in the University. This prize is awarded as soon as possible after the grades are available for the first semester. In case two men have the same average, other factors are considered, such as extracurricular activities and outside work.

Phi Kappa Phi Awards. The local chapter of Phi Kappa Phi, national honor society, gives two or more awards annually for graduate study to members of the local chapter who are graduates of the University or members of the graduating class, selected on the basis of scholastic record and promise of success in graduate work. Applications should be addressed to the local secretary of the society early in the second semester.

College of Engineering

American Society of Civil Engineers Awards. Junior membership for one year in the American Society of Civil Engineers, including the badge of the society and an embossed certificate of award, is presented each year by the Illinois Section of the society to one graduating civil engineer and by the Central Illinois Section to two graduating civil engineers and to one graduating non-civil engineer who have attained high scholarship averages and who have been active in promoting the affairs of the student chapter at the University.

American Society of Mechanical Engineers Awards. The Central Illinois Section of the society awards two prizes of $10 and $15 annually for the best papers prepared by senior student members of the society at Urbana.

Institute of the Aeronautical Sciences Awards. A two-year technical membership in the Institute of the Aeronautical Sciences is awarded to the graduating aeronautical engineering senior with the highest scholastic average, and a two-year technical membership in the Institute is awarded to the graduating aeronautical engineering senior for the best seminar paper delivered before the student organization. The winner of the latter is determined by the vote of the organization.

Prizes Not Limited to the University of Illinois

General Competitions

Intercollegiate Conference Medal. The Intercollegiate Conference, through its faculty representative of each conference institution, awards annually a medal to the student of the graduating class who has attained the greatest proficiency in athletics and in scholastic work.

Phi Kappa Phi (Sparks Memorial) Fellowship. Six fellowships of $1,200 each, for graduate study in any American institution of recognized standing, are awarded annually by Phi Kappa Phi, national honor society, in competitions open to members of the society in any American college or university where a chapter of the society exists. The recipients are selected by a national board from candidates recommended by the local chapters. Prospective candidates should file their applications with the local secretary of the society early in the second semester.

College of Engineering

American Institute of Mining and Metallurgical Engineers' Student Technical Paper Writing Contest. Competition is open to all student associates of the Institute, both undergraduate and graduate. The Chicago Section offers cash prizes of $100 and $50, and books for the best papers among colleges in this section. The best papers from local sections throughout the country are judged for national prizes.

American Society of Mechanical Engineers Prize. This society offers annually five prizes of $5 to $50 for the best papers prepared by senior student members of the society as judged in sectional competitions. This society also offers an annual prize of $25 to the student preparing the best paper on a selected topic in a nationally conducted competition.

Highway Prize. The Illinois Association of County Superintendents of Highways gives an annual prize of $25 for the best paper written by a senior in civil engineering on a subject in the highway field, such as design, construction, or maintenance. This is given with the understanding that the winning paper will be presented at the Annual Highway Conference.

John Smeaton Award. The Illinois Concrete Pipe Association gives an annual prize of $25 for the best paper written by a senior in the College of Engineering on the manufacture of concrete pipe.

Tau Beta Pi Fellowship. Six fellowships of approximately $650 each, for graduate study in any engineering college of recognized standing, are awarded annually by Tau Beta Pi, national engineering honor society, in competitions open to members of the organization in any American college or university where a chapter of Tau Beta Pi exists. The recipients are selected by a national board from candidates recommended by the local chapters. Prospective candidates should file their applications with the chairman of the board prior to March 1.

PART-TIME WORK OPPORTUNITIES

Within the College, other divisions of the University, and the cities of Urbana and Champaign are many job opportunities for students who must earn a part of their income. The University maintains a Student Employment Service, and students are encouraged to use its facilities. In addition, many undergraduates find, in their own engineering department or an allied department, part-time work that not only pays them in cash but increases their academic knowledge.

VIII. ADVISORY PROCEDURE

The University recognizes that many students when they first come to the campus have not definitely decided what type of college work to take, in spite of the numerous publications available in the high schools to assist them in choosing a college career. All new freshmen entering the University of Illinois take a group of freshman guidance tests which are administered by the University Student Counseling Bureau prior to registration. Students may thereafter make appointments to receive counsel from qualified psychologists who interpret the test results and advise them as to their aptitudes and abilities in the various fields of higher education.

The University also has various divisions that help the student with problems of housing, health, and social adjustment. Students are referred to such divisions when the need arises.

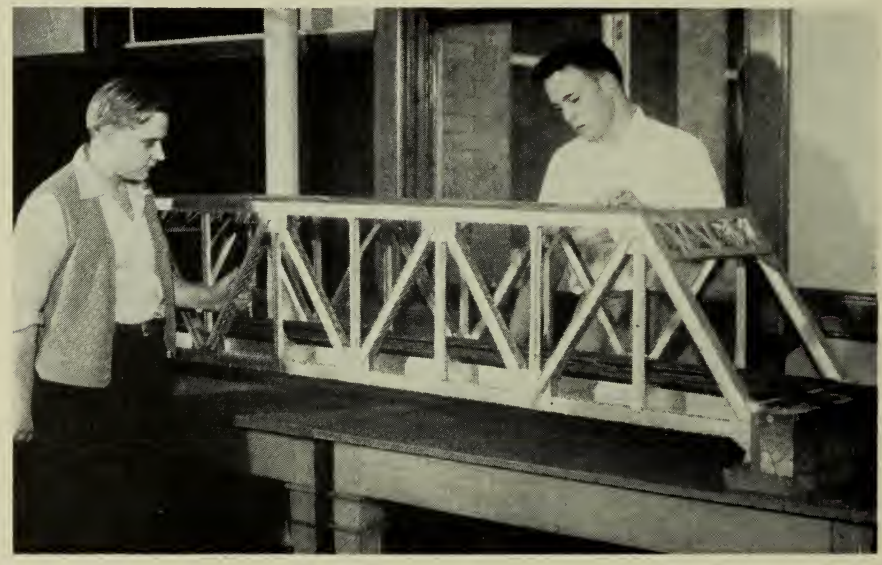
In addition, freshmen students in the College of Engineering confer with faculty advisers at registration time in arranging for their academic programs of study. The offices of the Associate and Assistant Deans, at 103 Civil Enginering Hall, have staff personnel available at all times to help the student with his educational problems, large or small.

For upperclassmen a complete advisory system for registration is operated by each department of the College, with faculty members assigned to guide and counsel individual students or groups of students. Each student has a conference with his adviser well in advance of registration, in order to allow sufficient time for a thorough analysis of the student's progress and a discussion of his eventual aims. These same advisers are available for additional counsel at any time during the semester.

Students should feel free to consult any of the engineering instructional or administrative staff on questions of academic studies, financial difficulties, or other personal problems. The academic progress of each student is evaluated at the midterm of each semester; those who are not progressing satisfactorily are counseled as to procedures that will help them to improve their status.

The entire philosophy of the College is to provide a friendly relationship with students in order to assure them the best possible technical and cultural education for their future place in society.

Quiz classes are small and active student participation is encouraged by close student-instructor contact



Students examining an erection model of the Dubuque, Iowa, bridge

IX. CURRICULA AND COURSES

THE COMMON PROGRAM FOR FRESHMEN

To gain a broad view of engineering fundamentals before the student makes his final choice of a particular branch, all freshmen in the College of Engineering take the same program.

First Year

FIRST SEMESTER	HOURS	SECOND SEMESTER	HOURS
Chem. 102 or 103—General Chemistry[1]	3 or 4	Chem. 104—Chemistry of Metallic Elements	4
G.E. 101—Engineering Drawing	3	G.E. 102—Engineering Geometry	3
Math. 123—Analytic Geometry[2]	5	Math. 133—Calculus	3
Hygiene 101—Health Lectures	2	Physics 106—Mechanics	4
Rhet. 101—Rhetoric and Composition	3	Rhet. 102—Rhetoric and Composition	3
G.E. 100—Engineering Lectures	0	Physical Education	1
Physical Education	1	Military (men)	1
Military (men)	1		
Total	18 or 19	*Total*	19

ADMINISTRATION

For certain important purposes, the Department of Agricultural Engineering is a unit in the College of Agriculture. Its curricula, however, are administered by the College of Engineering, and its head serves on the Executive Committee of the College of Engineering and on the Executive Staff of the Engineering Experiment Station.

The curricula in chemical engineering are administered, as a division of the Department of Chemistry, by the College of Liberal Arts and Sciences, but the head of that division serves on the Executive Committee of the College of Engineering and on the Executive Staff of the Engineering Experiment Station.

The curriculum in industrial engineering is administered by the Department of Mechanical Engineering.

The curriculum in sanitary engineering is administered by the Department of Civil Engineering.

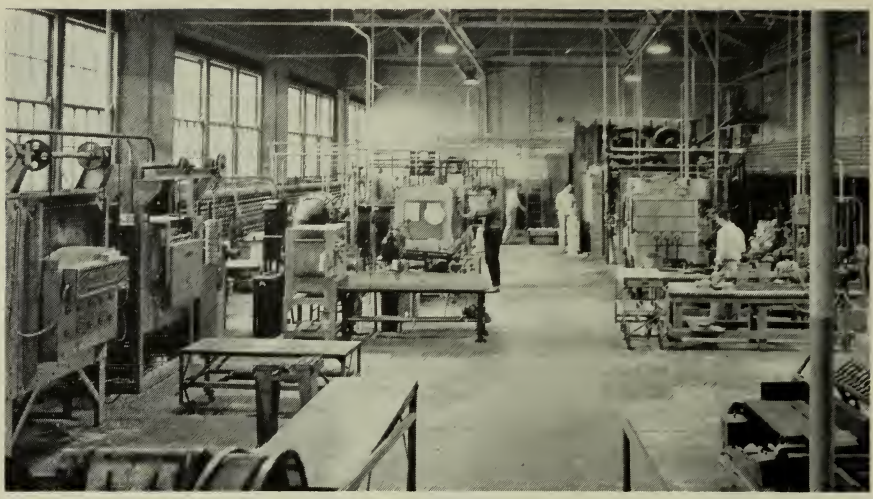
ELECTIVES AND OPTIONS

Each curriculum offers some elective opportunities; they may be specified as technical or nontechnical.

Technical electives include all courses in Mathematics, Chemistry and Chemical Engineering, Agricultural Engineering 282, 332, 341, 371

[1] Students entering in September, 1953, and thereafter may use only three hours of this course toward degrees in engineering.

[2] Math. 111 or 112, Algebra, and Math. 114, Trigonometry, for those entering with two or three units of high school mathematics. This also applies to those who do not pass the mathematics placement examination.



The Kiln laboratory for firing ceramic test pieces

and 393, and all courses in the College of Engineering not required in the student's curriculum except General Engineering 140, 141, 216, 220, 292 and Industrial Engineering 230 and 239.

Nontechnical electives include all courses in the College of Liberal Arts and Sciences except those in Mathematics, Chemistry and Chemical Engineering; all courses in the College of Commerce and Business Administration; Architecture 113, 217 and 218; Art 111, 112 and 115; Education 300 through 304; General Engineering 140, 141, 216, 220 and 292; Industrial Engineering 230 and 239; Journalism 215, 216 and 218; Landscape Architecture 164 and 174; and Music 100 through 123. The student may petition to receive credit for other courses which conform to the objectives of what are known as the social-humanistic studies. It is expected that the student will consult with his departmental advisor when selecting his nontechnical electives. Advisors will usually have lists of recommended courses to aid the student's choice if he is undecided about this aspect of his program.

Transfer students may substitute survey courses of nontechnical areas for their nontechnical electives, although circumstances may dictate some reduction in credit.

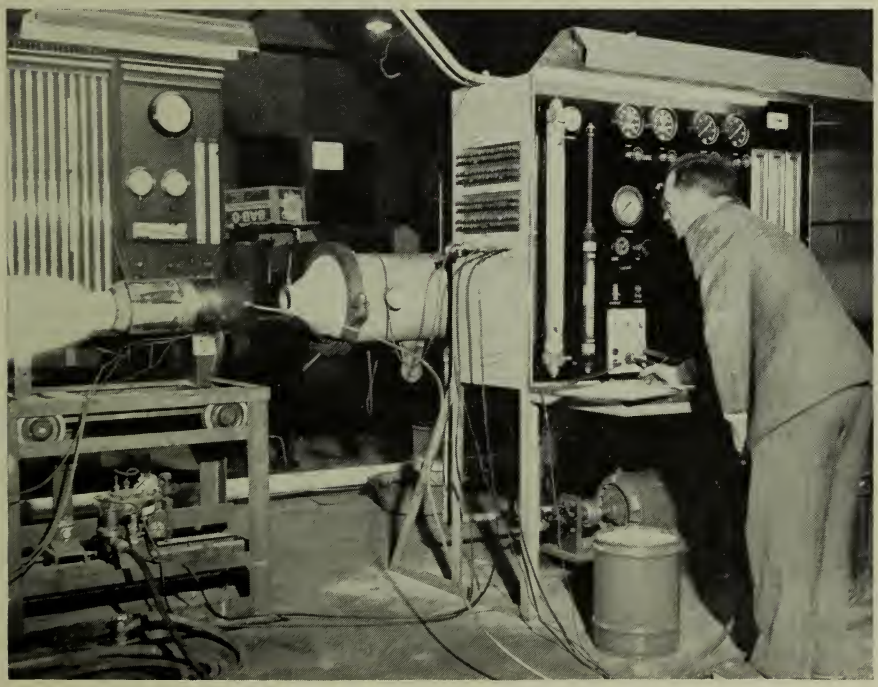
Advanced courses in Air Force, Military Science, and Naval Science may be substituted as specified by the individual departments for electives in most curricula. The larger core of Naval Science studies requires a nine-semester program.

An option is a group of related courses in a subdivision of a department's subject matter; in other words, it is a further area of specialization within a particular curriculum.

THE ENGINEERING CURRICULA

Aeronautical Engineering

This curriculum gives training in the fundamental principles of airframe and aircraft power plant design and construction. Since the rapid development of the aircraft industry provides many job opportunities for graduates, every effort is made to offer courses that give the fundamental knowledge necessary to understand the engineering principles on which these rapid advances are based. Instruction in supersonic aerodynamics and reaction-type engines is an example of work offered in an area of current and future importance. The required courses in the curriculum prepare the student for any of the several technical divisions of the aircraft industry, and the elective courses permit additional course work in the fields of airplane design, aircraft power plants, and aircraft production and maintenance engineering. The undergraduate curriculum is primarily aimed to give a broad and thorough background in aeronautical engineering with some opportunity to further particular interests by taking advanced work offered in elective courses. However, a high degree of specialization in the undergraduate program is not recommended. Graduate study and research are available in the various areas of aeronautical engineering.



Ram jet engine being tested in a 700-mile per hour air stream in the Aircraft Propulsion laboratory

Teaching Staff

Professors: H. S. Stillwell (Head of Department), M. Z. Krzywoblocki, R. W. McCloy, J. M. Coan, P. Torda.
Assistant Professors: C. H. Fletcher, H. H. Hilton, A. I. Ormsbee.

Curriculum in Aeronautical Engineering

For the Degree of Bachelor of Science in Aeronautical Engineering

First Year

Common Program for Freshmen (page 87)

Second Year

FIRST SEMESTER	HOURS	SECOND SEMESTER	HOURS
Math. 143—Calculus	5	Math. 341—Differential Equations	3
M.E. 182—Manufacturing Processes	3	Physics 108—Heat, Sound, Light	4
Physics 107—Electricity and Magnetism, Modern Physics	4	T.A.M. 156—Analytical Mechanics (Statics and Dynamics)	5
Modern History or Political Science[1]	3 or 4	Modern History or Political Science[1]	3 or 4
Physical Education	1	Physical Education	1
Military (men)	1	Military (men)	1
Total	17 or 18	*Total*	17 or 18

Third Year

Aero. E. 211—Aerodynamics	3	Aero. E. 214—Aerodynamics of the Airplane	3
G.E. 203—Aircraft Drafting and Lofting	3	Aero. E. 220—Aircraft Structures	3
Met. E. 160—Metallurgy for Engineers	3	Aero. E. 232—Aerothermodynamics	3
M.E. 205—Thermodynamics	3	E.E. 202—D.C. and A.C. Circuits and Machines	2
T.A.M. 221—Resistance of Materials	3	E.E. 203—D.C. and A.C. Circuits and Machines Laboratory	1
T.A.M. 223—Resistance of Materials Laboratory	1	M.E. 222—Mechanics of Machinery	3
Nontechnical Electives[2, 3]	3	Nontechnical Electives[2, 3]	3 or 4
Total	19	*Total*	18 or 19

Fourth Year

Aero. E. 221—Aircraft Structures	3	Aero. E. 216—Aerodynamics of Compressible Fluids	3
Aero. E. 233—Aircraft Propulsion	3	Aero. E. 222—Indeterminate Aircraft Structures	3
Aero. E. 241—Airplane Design	3	Aero. E. 242—Airplane Design	3
Aero. E. 261—Aerodynamics Laboratory	2	Aero. E. 262—Aircraft Engine Laboratory	1
Aero. E. 291—Seminar	1	Aero. E. 264—Aircraft Structures Laboratory	2
Aero. E. 299—Inspection Trip[4]	0	Aero. E. 292—Seminar	1
E.E. 217—Electrical Measurements	3	Technical Electives	3
Technical or Nontechnical Electives[3]	3		
Total	18	*Total*	16

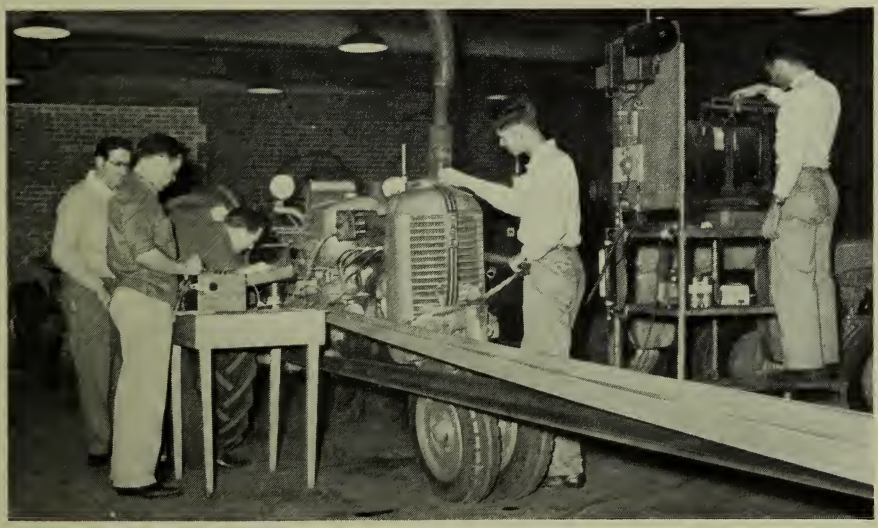
[1] Recommended sequences are Hist. 111 and 112, Pol. Sci. 150 and 151, and D.G.S. 121 and 122.
[2] Recommended to be taken in the Division of Social Sciences.
[3] Advanced Military courses may be substituted for these electives.
[4] Not required until further notice.

Agricultural Engineering

Graduates from this curriculum enter teaching, research, and commercial and industrial work in agricultural engineering. Instruction is given under four main headings: (1) Power and machinery, including consideration of the types available and applicable to farm operation; the design of implements, machines, vehicles, and other equipment; and the development and use of various suitable materials of construction. (2) Rural electrification, including study of the problems of providing electrical service to rural areas, and the development and use of the farm machinery and equipment involved in the extensive use of electricity in agriculture. (3) Farm buildings and housing, including design, location, and arrangement; functional requirements, lighting, heating, and ventilating of farm buildings; and provision for refrigeration equipment, water supplies, and sewage disposal. (4) Soil and water conservation, including drainage, soil erosion control, flood control, irrigation, land clearing, and physical improvements. Options are available in machinery and power, and in structures and conservation.

Teaching Staff

Professors: E. W. Lehmann (Head of Department), D. G. Carter, R. C. Hay, K. H. Hinchcliff (on leave), G. E. Pickard, R. I. Shawl.
Associate Professor: A. L. Young.
Assistant Professors: F. W. Andrew, J. W. Matthews.
Instructors: W. Bowers, J. T. Clayton, J. O. Curtis, B. A. Jones, R. W. Kleis, W. F. Lytle, B. F. Muirheid, H. L. Wakeland.



Studying tractor power, fuel consumption and valve guide temperatures

Curriculum in Agricultural Engineering

For the Degree of Bachelor of Science in Agricultural Engineering

First Year

Common Program for Freshmen (page 87)

Second Year

FIRST SEMESTER	HOURS	SECOND SEMESTER	HOURS
Agr. Eng. 111—Farm Structures and Soil and Water Engineering	3	Agr. Eng. 112—Tractors and Field Machinery	3
Botany 100—General Botany	4	Agron. 121—Crop Production	4
Math. 143—Calculus	5	Physics 108—Heat, Sound, Light	4
Physics 107—Electricity and Magnetism, Modern Physics	4	T.A.M. 156—Analytical Mechanics (Statics and Dynamics)	5
Physical Education	1	Physical Education	1
Military (men)	1	Military (men)	1
Total	18	*Total*	18

Third Year

Power and Machinery Option

Agr. Eng. 231—Advanced Agricultural Machinery	3	Agr. Eng. 282—Electricity in Agriculture	3
E.E. 206—D.C. and A.C. Circuits	3	Econ. 108—Elements of Economics	3
E.E. 207—D.C. and A.C. Circuits Laboratory	1	Geol. 105—Agricultural Geology	3
M.E. 221—Mechanics of Machinery	5	M.E. 202—Thermodynamics	3
T.A.M. 221—Resistance of Materials	3	M.E. 224—Design of Machine Elements	3
T.A.M. 223—Resistance of Materials Laboratory	1	Nontechnical Electives	3
Nontechnical Electives	3		
Total	19	*Total*	18

Farm Structures, Soil and Water Engineering Option

C.E. 115—General Surveying	3	Agr. Econ. 120—Farm Management	3
C.E. 235—Plain Concrete	2	Agr. Eng. 282—Electricity in Agriculture	3
Econ. 108—Elements of Economics	3	C.E. 261—Structural Analysis	4
E.E. 206—D.C. and A.C. Circuits	3	Geol. 105—Agricultural Geology	3
E.E. 207—D.C. and A.C. Circuits Laboratory	1	T.A.M. 232—Fluid Mechanics	3
T.A.M. 221—Resistance of Materials	3	T.A.M. 234—Fluid Mechanics Laboratory	1
T.A.M. 223—Resistance of Materials Laboratory	1		
Nontechnical Electives	3		
Total	19	*Total*	17

Fourth Year

Power and Machinery Option

Agr. Econ. 120—Farm Management	3	Agr. Eng. 332—Design of Agricultural Machinery	3
Agr. Eng. 299—Inspection Trip	0	Agr. Eng. 393—Special Problems	3
Agr. Eng. 341—Farm Power	3	Agron. 201—Soils	5
M.E. 271—Design of Machine Elements	3	M.E. 234—Heat Treatment of Metals	3
M.E. 182—Manufacturing Processes	3	Technical or Nontechnical Electives	3
Nontechnical Electives	5		
Total	17	*Total*	17

FARM STRUCTURES, SOIL AND WATER ENGINEERING OPTION

FIRST SEMESTER	HOURS	SECOND SEMESTER	HOURS
Agr. Eng. 299—Inspection Trip	0	Agr. Eng. 393—Special Problem	3
Agr. Eng. 351—Hydraulics of Soil and Water Engineering	3	Agr. Eng. 371—Advanced Farm Structures	3
Agron. 201—Soils	5	C.E. 264—Structural Design	5
C.E. 262—Structural Analysis	3	Nontechnical Electives	3
C.E. 263—Elementary Structural Design	2	Technical or Nontechnical Electives	3
C.E. 290—Contracts and Specifications	2		
Nontechnical Electives	3		
Total	18	*Total*	17

Ceramic Engineering

The curriculum in ceramic engineering includes basic courses in chemistry, physics, and engineering together with study of the properties of materials, products, and processing methods used in a variety of industries in which the raw materials are generally nonmetallic minerals and mainly silicates. The ceramic industries include the manufacture of all types of clay products such as brick and tile, pottery and porcelain; a great variety of refractories for use at high temperatures;

The use of the microscope for examining microstructure of ceramic materials

products for thermal insulation; glass articles of all sorts; vitreous enamels; and abrasives and cements. An opportunity for some degree of specialization in such fields is provided by elective courses.

Training in ceramic engineering prepares men for positions of responsibility in investigation of the physical and chemical characteristics of raw materials; in technical supervision and control of processing and manufacturing operations; in the design and construction of dryers, kilns, and other plant equipment; and in engineering service in connection with sales and applications of ceramic materials, products, and manufacturing equipment. Scientific research and development of new processes and products affords opportunities, especially for those who continue with graduate study in this field.

Teaching Staff

Professors: A. I. Andrews (Head of Department), R. L. Cook, R. K. Hursh, F. V. Tooley.
Associate Professor: A. W. Allen.
Assistant Professor: E. D. Lynch.
Instructors: R. J. Beals, J. A. Nelson.

Curriculum in Ceramic Engineering

For the Degree of Bachelor of Science in Ceramic Engineering

First Year

Common Program for Freshmen (page 87)

Second Year

FIRST SEMESTER	HOURS	SECOND SEMESTER	HOURS
Cer. E. 101—Introduction to Ceramic Engineering	3	Cer. E. 102—Ceramic Processes and Equipment	3
Chem. 123—Quantitative Analysis	5	Geol. 130—Mineralogy for Engineers	3
Math. 143—Calculus	5	Physics 108—Heat, Sound, Light	4
Physics 107—Electricity and Magnetism, Modern Physics	4	T.A.M. 154—Analytical Mechanics (Statics and Dynamics)	4
Physical Education	1	Technical or Nontechnical Electives	3
Military (men)	1	Physical Education	1
		Military (men)	1
Total	19	*Total*	19

Third Year

Cer. E. 201—Ceramic Technology	5	Cer. E. 202—Ceramic Technology	5
Cer. E. 203—Principles of Drying	3	Cer. E. 204—Kilns, Furnaces, Firing Operations	3
Chem. 245—Elementary Physical Chemistry	3	Cer. E. 221—Pyrometry	2
T.A.M. 221—Resistance of Materials	3	Technical Electives	3
T.A.M. 223—Resistance of Materials Laboratory	1	Nontechnical Electives	3
Nontechnical Electives	3		
Total	18	*Total*	16

Fourth Year

FIRST SEMESTER	HOURS	SECOND SEMESTER	HOURS
Cer. E. 271—Ceramic Engineering Design	2	Cer. E. 272—Ceramic Engineering Design	3
Cer. E. 211—Ceramic Bodies and Glazes	5	Cer. E. 218—Refractories	3
Cer. E. 299—Inspection Trip	0	E.E. 204—Application of Electrical Equipment	2
C.E. 260—Structural Engineering	3	E.E. 205—Application of Electrical Equipment Laboratory	1
E.E. 202—D.C. and A.C. Circuits and Machines	2	Technical Electives	5
E.E. 203—D.C. and A.C. Circuits and Machines Laboratory	1	Technical or Nontechnical Electives	3
Technical Electives	2		
Technical or Nontechnical Electives	3		
Total	18	*Total*	17

Chemical Engineering

The curricula in chemical engineering are designed to make students competent to develop, design, and operate new processes, and improve existing processes, in the chemical industries. Training in the fundamentals of chemistry and physics and in the application of mathematics to these sciences is essential before the actual courses in chemical engineering are begun. Since some of the work may involve the design of heavy equipment, students must also understand the principles of mechanical and electrical engineering. Training in engineering drawing, the ability to speak and write English fluently, and skill in reading technical literature in foreign languages are highly useful.

The principles of chemical engineering are based on energy and material balances, and rates of physical and chemical reactions, especially in continuous processes. These principles apply in unit operations like the handling of liquids and gases; the transfer of heat; the absorption of gases; and the processes of extraction, distillation, evaporation, and drying. Seniors solve many practical problems, some of them economic, very much like those found in the modern chemical industry.

The minimum language requirement for graduation in chemical engineering is the equivalent of two years of college work in German or French, or one year in each. A student who has had two years of French or German in high school should study the other language in the University. (Russian may be substituted for French.) Students entering with two units of credit for German or French (two units in high school being equivalent to one year in college) should complete this minimum requirement in their freshman year. Those entering with less than two units in German or French should complete this requirement in their sophomore year or as early as possible.

An optional four-year curriculum in chemical engineering is available for the students who are especially interested in the fields of industrial

fermentation, pharmaceutical, and biochemical manufacturing industries. Students who enter without adequate preparation in chemistry, mathematics, and languages will find it difficult to complete either of the curricula in chemical engineering in four years. An optional five-year program is available and is recommended especially for those who plan to seek positions in sales, technical service, and administration in the chemical industry, and who wish to broaden their technical training through courses in the humanities, economics, and labor and business administration. All curricula including the five-year programs lead to the degree of Bachelor of Science in Chemical Engineering.

Students should note that they must have a 3.5 general average for registration in these curricula after they have attained junior standing.

Teaching Staff

Professors: H. F. Johnstone (Head of Division), H. G. Drickamer, F. G. Straub, S. Swann, Jr.
Assistant Professors: R. K. Finn, T. J. Hanratty, M. S. Peters, J. W. Westwater.

Curriculum in Chemical Engineering

For the Degree of Bachelor of Science in Chemical Engineering

First Year

FIRST SEMESTER	HOURS	SECOND SEMESTER	HOURS
Chem. 107[1]—General Chemistry and Qualitative Analysis	5	Chem. 108[1]—General Chemistry and Qualitative Analysis	5
G.E. 106—Elements of Drawing	3	Math. 132—Calculus[2]	5
Hygiene 101—Health Lectures	2	Physics 106—Mechanics	4
Math. 122—Analytic Geometry[2]	4	Rhet. 102—Rhetoric and Composition	3
Rhet. 101—Rhetoric and Composition	3	Physical Education	1
Physical Education	1	Military (men)	1
Military (men)	1		
Total	19	*Total*	19

Second Year

Chem. 124—Quantitative Analysis	5	Chem. 240—Elementary Physical Chemistry	3
Math. 142—Calculus	3	Chem. 241—Elementary Physical Chemistry Laboratory	1
Physics 107—Electricity and Magnetism, Modern Physics	4	Physics 108—Heat, Sound, Light	4
German or French[3]	4	T.A.M. 150—Analytical Mechanics (Statics)	2
Physical Education	1	German or French[3]	4
Military (men)	1	Electives[4]	3
		Physical Education	1
		Military (men)	1
Total	18	*Total*	19

Third Year

General Option

FIRST SEMESTER	HOURS	SECOND SEMESTER	HOURS
Ch.E. 261—Stoichiometry	3	Ch.E. 370—Chemical Engineering Thermodynamics	3
Ch.E. 267—Measurements and Instrumentation Laboratory	2	Ch.E. 371—Principles of Chemical Engineering	4
Chem. 234—Organic Chemistry	5	Ch.E. 372—Unit Operations Laboratory	2
Chem. 342—Elementary Physical Chemistry	3	Chem. 336—Organic Chemistry	3
Electives[4]	3	Chem. 337—Organic Chemistry Laboratory	2
		T.A.M. 221—Resistance of Materials	3
		T.A.M. 223—Resistance of Materials Laboratory	1
Total	16	*Total*	18

Bioengineering Option

Bact. 300—General Microbiology	5	Ch.E. 370—Chemical Engineering Thermodynamics	3
Ch.E. 261—Stoichiometry	3	Ch.E. 371—Principles of Chemical Engineering	4
Chem. 234—Organic Chemistry	5	Ch.E. 372—Unit Operations Laboratory	2
T.A.M. 221—Resistance of Materials	3	Chem. 336—Organic Chemistry	3
T.A.M. 223—Resistance of Materials Laboratory	1	Chem. 350—Biochemistry	3
		Chem. 354—Biochemistry Laboratory	2
Total	17	*Total*	17

Fourth Year

General Option

Ch.E. 266—Inspection Trip	½	Ch.E. 266—Inspection Trip	½
Ch.E. 373—Principles of Chemical Engineering	4	Ch.E. 377—Chemical Engineering Technology	3
Ch.E. 374—Unit Operations Laboratory	2	Ch.E. 379—Chemical Engineering Projects	2
Chem. 344—Principles of Chemical Thermodynamics	2	Ch.E. 381—Chemical Engineering Plant Design	3
E.E. 206—D.C. and A.C. Circuits	3	E.E. 208—D.C. and A.C. Apparatus	3
E.E. 207—D.C. and A.C. Circuits Laboratory	1	E.E. 209—D.C. and A.C. Apparatus Laboratory	1
M.E. 204—Mechanical Engineering Laboratory	2	Electives[5]	5
Electives[5]	3		
Total	17½	*Total*	17½

See footnotes on following page.

BIOENGINEERING OPTION

FIRST SEMESTER	HOURS	SECOND SEMESTER	HOURS
Ch.E. 266—Inspection Trip	½	Ch.E. 266—Inspection Trip	½
Ch.E. 373—Principles of Chemical Engineering	4	Ch.E. 381—Chemical Engineering Plant Design	3
Ch.E. 385—Bioengineering	5	Ch.E. 386—Bioengineering	5
Chem. 337—Organic Chemistry Laboratory	2	Chem. 344—Principles of Chemical Thermodynamics	2
Chem. 342—Physical Chemistry	3	E.E. 204—Application of Electrical Equipment	2
E.E. 202—D.C. and A.C. Circuits and Machines	2	E.E. 205—Electrical Equipment Laboratory	1
E.E. 203—D.C. and A.C. Circuits and Machines Laboratory	1	Electives[4]	4
Total	17½	*Total*	17½

[1] Students without entrance credit in chemistry take the sequence Chem. 101, 106, 110, 124, etc.
[2] Students without the required entrance credit in mathematics take Math. 112, 114, 122, 132, and 142.
[3] Two years of French and/or German are required for the B.S. degree. Two units of high school credit in either of these languages is equivalent to one year of college credit. Students entering without German or French in high school may substitute the second year of the language requirement for the six hours of electives referred to in footnote 4.
[4] Six hours of electives must be chosen from the Divisions of Humanities or Social Sciences with the approval of the adviser. The courses are intended to broaden the engineer and provide an interest and a liberal education in history, language, literature, philosophy, political science, or public speaking.
[5] Five hours of electives must be chosen with the approval of the adviser from advanced courses in chemical engineering, chemistry, physics, mathematics, metallurgy, or other closely allied subjects.

Civil Engineering

This curriculum offers systematic training in the principles and procedures employed in professional practice. Emphasis is placed on basic principles and design procedures, rather than on routine computations or on special techniques which can readily be obtained on the job.

The various courses offered concern the design and construction of bridges, buildings, dams, retaining walls, foundations, aircraft structures, and airports; the design, construction, and operation of water supply and sewage disposal systems, highways, and railways; methods and engineering works involved in flood control and drainage; and the preparation of cost estimates, contracts, and specifications. Seniors may specialize somewhat in the more important branches of civil engineering through options in structures; transportation by highway, railway, and airway; hydraulic engineering; and construction.

A summer surveying camp provides field instruction in surveying between the sophomore and junior years, and an arrangement is in effect with the Illinois State Highway Department under which students may get engineering experience, with pay, during their college summers.

Teaching Staff

Professors: W. C. HUNTINGTON (Head of Department), H. E. BABBITT, J. G. CLARK, E. DANNER, G. H. DELL, J. C. DIETZ, J. J. DOLAND, E. E. KING (Emeritus), N. M. NEWMARK, W. A. OLIVER, R. B. PECK, W. H. RAYNER (Emeritus), M. O. SCHMIDT, T. C. SHEDD, J. VAWTER, C. C. WILEY (Emeritus), W. M. WILSON (Emeritus).

A surveying class plane table party

Associate Professors: W. J. Austin, E. E. Bauer, E. R. Bretscher, E. J. Daily, L. E. Goodman, W. W. Hay, W. H. Munse, C. P. Siess, T. H. Thornburn.
Assistant Professors: C. P. Atkins, J. W. Briscoe, H. H. Connolly, C. S. Danner, D. A. Day, J. C. Guillou, N. Khachaturian, W. S. Pollard.
Associate: H. O. Ireland.
Lecturer: K. Terzaghi.
Instructors: J. D. Haltiwanger, J. R. Leek, G. A. Young.

Curriculum in Civil Engineering

For the Degree of Bachelor of Science in Civil Engineering

First Year

Common Program for Freshmen (page 87)

Second Year

FIRST SEMESTER	HOURS	SECOND SEMESTER	HOURS
C.E. 105—Plane Surveying	2	C.E. 106—Surveying	3
C.E. 160—Building Construction	3	Geol. 150—Engineering Geology	3
Math. 143—Calculus	5	Physics 108—Heat, Sound, Light	4
Physics 107—Electricity and Magnetism, Modern Physics	4	T.A.M. 150—Analytical Mechanics (Statics)	2
G.E. 111—Advanced Drafting for Civil Engineers	2	Nontechnical Electives	3
Physical Education	1	Physical Education	1
Military (men)	1	Military (men)	1
Total	18	*Total*	17

Summer Surveying Camp (C.E. 207—5 hours) follows Second Year[1]

[1] Students transferring to civil engineering or sanitary engineering with advanced standing, who have not completed all requirements in surveying, are required to attend the summer surveying camp at Camp Rabideau in northern Minnesota.

Third Year

FIRST SEMESTER	HOURS	SECOND SEMESTER	HOURS
C.E. 230—Soils and Bituminous Materials	2	C.E. 220—Highways	3
C.E. 235—Plain Concrete	2	C.E. 262—Structural Analysis	3
C.E. 261—Structural Analysis	4	C.E. 263—Elementary Structural Design	2
M.E. 201—Mechanical Power Equipment	3	E.E. 202—D.C. and A.C. Circuits and Machines, *or* Approved Electives	2
T.A.M. 211—Analytical Mechanics (Dynamics)	3	E.E. 203—D.C. and A.C. Circuits and Machines Laboratory, *or* Approved Elective	1
T.A.M. 221—Resistance of Materials	3	T.A.M. 232—Fluid Mechanics	3
T.A.M. 223—Resistance of Materials Laboratory	1	T.A.M. 234—Fluid Mechanics Laboratory	1
		Technical or Nontechnical Electives	2
Total	18	*Total*	17

Fourth Year

General Option

C.E. 240—Water Supply	4	C.E. 241—Sewerage	3
C.E. 264—Structural Design	5	C.E. 296—Professional Practice	0
C.E. 290—Contracts and Specifications	2	C.E. 370—Foundations and Retaining Walls	3
C.E. 295—Professional Practice	0	Technical Electives	5
C.E. 299—Inspection Trip	0	Technical or Nontechnical Electives	4
Nontechnical Electives	3		
Technical Electives	3		
Total	17	*Total*	15

Construction Option

C.E. 237—Estimates and Costs	2	C.E. 239—Construction Planning and Management	4
C.E. 238—Construction Equipment and Methods	3	C.E. 290—Contracts and Specifications	2
C.E. 248—Water Supply and Sewerage	4	C.E. 296—Professional Practice	0
C.E. 264—Structural Design	5	C.E. 70—Foundations and Retaining Walls	3
C.E. 295—Professional Practice	0	I.E. 230—Labor Relations	3
C.E. 299—Inspection Trip	0	Technical or Nontechnical Electives	3
Nontechnical Electives	3		
Total	17	*Total*	15

Highway Option

C.E. 231—Advanced Highway Materials	2	C.E. 222—Highway and Municipal Design	4
C.E. 248—Water Supply and Sewerage	4	C.E. 264—Structural Design	5
C.E. 290—Contracts and Specifications	2	C.E. 296—Professional Practice	0
C.E. 295—Professional Practice	0	C.E. 332—Engineering Properties of Soils	2
C.E. 299—Inspection Trip	0	C.E. 370—Foundations and Retaining Walls	3
C.E. 323—Highway Traffic Characteristics	4	Technical or Nontechnical Electives	3
Nontechnical Electives	3		
Total	15	*Total*	17

Hydraulics Option

FIRST SEMESTER	HOURS	SECOND SEMESTER	HOURS
C.E. 250—Hydrology	3	C.E. 248—Water Supply and Sewerage	4
C.E. 252—Water Resources Planning and Development	3	C.E. 290—Contracts and Specifications	2
C.E. 264—Structural Design	5	C.E. 296—Professional Practice	0
C.E. 295—Professional Practice	0	C.E. 355—Water Power	4
C.E. 299—Inspection Trip	0	C.E. 371—Earth and Masonry Structures	2
C.E. 370—Foundations and Retaining Walls	3	Technical or Nontechnical Electives	3
Nontechnical Electives	3		
Total	17	*Total*	15

Railway Option

C.E. 226—Railway Location and Operation	3	C.E. 225—Railway Construction and Maintenance	3
C.E. 227—Terminals	2	C.E. 229—Signals	2
C.E. 264—Structural Design	5	C.E. 248—Water Supply and Sewerage	4
C.E. 290—Contracts and Specifications	2	C.E. 296—Professional Practice	0
C.E. 295—Professional Practice	0	C.E. 332—Engineering Properties of Soils	2
C.E. 299—Inspection Trip	0	Technical or Nontechnical Electives	3
C.E. 370—Foundations and Retaining Walls	3	Nontechnical Electives	3
Total	15	*Total*	17

Structural Option

C.E. 264—Structural Design	5	C.E. 248—Water Supply and Sewerage	4
C.E. 295—Professional Practice	0	C.E. 265—Structural Design	4
C.E. 299—Inspection Trip	0	C.E. 290—Contracts and Specifications	2
C.E. 361—Statically Indeterminate Structures	3	C.E. 296—Professional Practice	0
C.E. 370—Foundations and Retaining Walls	3	C.E. 362—Statically Indeterminate Structures	3
Technical or Nontechnical Electives	3	C.E. 371—Earth and Masonry Structures	2
Nontechnical Electives	3		
Total	17	*Total*	15

Electrical Engineering

Actual work in electrical engineering subjects begins in the sophomore year with a course in electric circuits and fields. Beginning with the third year, the courses are arranged in three options covering the fields of power, illumination, and communication engineering. These options are designed, not to make specialists, but rather to give a wide background in the fundamental theory and in methods of attack on some of the more difficult problems. In each option technical courses and accompanying laboratory exercises, covering the generation, transmission, distribution, radiation, measurement, and utilization of electrical energy in all frequency ranges, give a broad general training, supplemented by other courses which emphasize the fields of the options.

Provision is made whereby students may do individual work, particularly experimental investigation, in the junior and senior years — provided that they have shown exceptional interest and ability in their first two years in college and submit to the adviser an integrated program.

Teaching Staff

Professors: E. C. Jordan (Head of Department), J. Bardeen, W. L. Emery, M. A. Faucett (on leave), G. H. Fett, L. Goldstein, H. N. Hayward, M. S. Helm, V. P. Hessler, C. A. Keener, A. R. Knight, J. O. Kraehenbuehl, N. M. McLachlan, E. B. Paine (Emeritus), M. B. Reed, E. A. Reid, J. T. Tykociner (Emeritus), H. M. von Foerster, N. Wax.

Associate Professors: G. E. Anner, L. B. Archer, D. S. Babb, P. D. Coleman, P. R. Egbert, W. J. Fry, H. W. Horn, T. A. Murrell, G. R. Peirce, P. F. Schwarzlose, C. E. Skroder, R. M. Wainwright, H. D. Webb, E. K. Weise, J. E. Williams.

Assistant Professors: W. G. Albright, A. D. Bailey, J. A. Barkson, P. A. Bauman, L. O. Brown, A. S. Chodakowski, C. L. Coates, M. H. Crothers, C. E. Drumheller, R. H. DuHamel, M. Gilden, D. F. Hang, P. K. Hudson, J. U. Jeffries, H. E. Koenig, M. S. McVay, J. P. Neal, J. E. Robertson, E. W. Schwarz, D. W. C. Shen.

Instructors: M. Fisher, P. E. Mast, A. W. Swago.

Curriculum in Electrical Engineering

For the Degree of Bachelor of Science in Electrical Engineering

First Year

Common Program for Freshmen (page 87)

Second Year

FIRST SEMESTER	HOURS	SECOND SEMESTER	HOURS
Econ. 108—Elements of Economics	3	E.E. 126—Electric Circuits and Fields	4
Math. 143—Calculus	5	Physics 108—Heat, Sound, Light	4
Physics 107—Electricity and Magnetism, Modern Physics	4	T.A.M. 154—Analytical Mechanics (Statics and Dynamics)	4
Speech 101—Principles of Effective Speaking	3	Econ. 248—Personnel Administration	3
Physical Education	1	Physical Education	1
Military (men)	1	Military (men)	1
Total	17	*Total*	17

Third Year

Power Engineering and Communication Engineering Options

E.E. 229—Electric and Magnetic Fields	3	E.E. 288—Economic Aspects of Engineering	3
E.E. 320—Circuit Analysis	4	E.E. 322—Circuit Analysis	4
E.E. 321—Circuit Laboratory	1	E.E. 323—Circuit Laboratory	1
Math. 345—Differential Equations and Orthogonal Functions	3	E.E. 334—Electrical Power Apparatus, and E.E. 335—Electrical Power Apparatus Laboratory,[1] *or* E.E. 351—Networks and Lines[2]	4
T.A.M. 221—Resistance of Materials	3	E.E. 341—Electronics	4
T.A.M. 223—Resistance of Materials Laboratory	1	M.E. 202—Thermodynamics	3
Nontechnical Electives[3]	3		
Total	18	*Total*	19

ILLUMINATION ENGINEERING OPTION

FIRST SEMESTER	HOURS	SECOND SEMESTER	HOURS
		E.E. 260—Fundamentals of Illumination	3
		E.E. 322—Circuit Analysis	4
Same as for Power and Communication Options		E.E. 323—Circuit Laboratory	1
		E.E. 341—Electronics	4
		E.E. 361—Elements of Illumination Engineering Design	4
		Mktg. 272—Industrial Selling, *or* Nontechnical Electives[3]	3
		Total	19

Fourth Year

POWER ENGINEERING OPTION

E.E. 268—Fundamentals of Illumination Engineering	2	E.E. 292—Seminar	1
E.E. 299—Inspection Trip	0	E.E. 338—Electrical Power Apparatus	3
E.E. 336—Electrical Power Apparatus	4	E.E. 339—Electrical Power Apparatus Laboratory	1
E.E. 337—Electrical Power Apparatus Laboratory	2	M.E. 203—Power Plant Equipment	3
E.E. 347—Industrial Electronics	4	Technical Electives[4]	7
E.E. 378—Fundamentals of Power Transmission Engineering	3	Nontechnical Electives[3]	3
Nontechnical Electives[3]	3		
Total	18	*Total*	18

COMMUNICATION ENGINEERING OPTION

E.E. 292—Seminar	1	E.E. 332—Electrical Machinery	3
E.E. 299—Inspection Trip	0	E.E. 333—Electrical Machinery Laboratory	1
E.E. 330—Electrical Machinery	3	E.E. 355—Fields and Waves	4
E.E. 331—Electrical Machinery Laboratory	1	Technical Electives	4
E.E. 349—Electronic Tube Circuits	5	Nontechnical Electives[3]	6
E.E. 353—Radio Circuits	4		
Technical Electives[4]	4		
Total	18	*Total*	18

ILLUMINATION ENGINEERING OPTION

E.E. 299—Inspection Trip	0	E.E. 292—Seminar	1
E.E. 330—Electrical Machinery	3	E.E. 332—Electrical Machinery	3
E.E. 331—Electrical Machinery Laboratory	1	E.E. 333—Electrical Machinery Laboratory	1
E.E. 347—Industrial Electronics	4	E.E. 364—Illumination Design and Economics	4
E.E. 360—Engineering of the Illumination Surround	3	E.E. 365—Illumination Design Laboratory	1
E.E. 362—Principles of Illumination Engineering	4	E.E. 366—Illumination Sources	3
E.E. 363—Illumination and Photometry Laboratory	2	Mktg. 373—Sales Management, *or* Nontechnical Electives[3]	2
Arch. 141—Materials and Methods of Construction[3]	2	Arch. 142—Materials and Methods of Construction[3]	2
Total	19	*Total*	17

[1] E.E. 334 and E.E. 335 to be omitted by students in the communication engineering option.
[2] E.E. 351 to be omitted by students in the power engineering option.
[3] These courses will be waived for students in Advanced Military.
[4] Three hours of technical electives will be waived for students in Advanced Military.

The Electrical Engineering Building

Engineering Physics

The curriculum in engineering physics is designed to give the thorough fundamental training necessary in view of the increasing complexity of engineering research, development, and application. The work of the first two years is much like that in the other engineering curricula. In the last two years, stress is placed on advanced courses in physics, mathematics, and chemistry. However, a liberal amount of time is allowed for the study of any branch of engineering in which the student is especially interested; the details of technical application are left to be learned in connection with a particular job. By careful choice of electives, the curriculum can be made to serve as a basis for graduate study in some field of engineering or in physics itself.

Besides offering the curriculum in engineering physics, the Department of Physics teaches those courses in general physics which are required of all engineering students and offers similar courses to students in other colleges.

Students who wish additional work in physics will find advanced courses available in electricity and electronics, heat, light and optics, radiation, and nuclear physics.

Teaching Staff

Professors: F. W. Loomis (Head of Department), G. M. Almy (Associate Head), J. S. Allen, J. Bardeen, J. H. Bartlett, A. O. Hanson, D. W. Kerst, J. S. Koehler, P. G. Kruger, A. Longacre, E. M. Lyman, R. J. Maurer, A. Nordsieck, F. Seitz.

Associate Professors: R. A. Becker, G. F. Chew, R. B. Duffield (on leave), R. D. Hill (on leave), R. F. Paton, C. A. Wert.
Assistant Professors: G. Ascoli, P. Axel, L. S. Lavatelli, D. Lazarus, F. E. Low, D. E. Mapother, R. D. Rawcliffe, C. P. Slichter, J. H. Smith, J. N. Snyder.
Instructors: P. Gibbs, G. Salzman, R. A. Schmitt, J. C. Wheatley.

Curriculum in Engineering Physics

For the Degree of Bachelor of Science in Engineering Physics

First Year

Common Program for Freshmen (page 87)

Second Year[1]

FIRST SEMESTER	HOURS	SECOND SEMESTER	HOURS
Physics 107—Electricity and Magnetism, Modern Physics	4	Physics 108—Heat, Sound, Light	4
Math. 143—Calculus	5	Physics 341—Electricity and Magnetism	4
German, *or* Nontechnical Electives[2]	4	German, *or* Nontechnical Electives[2]	4
Nontechnical Electives[2]	3	Math. 343—Advanced Calculus[3]	3
Physical Education	1	Physical Education	1
Military (men)	1	Military (men)	1
Total	18	*Total*	17

Third Year[1]

Physics 342—Electricity and Magnetism	4	Physics 343—Vacuum Tubes[5]	4
Physics 321—Theoretical Mechanics	3	Physics 322—Mechanics	3
Math. 345—Differential Equations and Orthogonal Functions[3]	3	Physics 360—Heat, *or* M.E. 205—Thermodynamics	3
E.E. 320—A.C. Circuits[1]	4	Technical or Nontechnical Electives	4
E.E. 321—A.C. Circuits Laboratory[1]	1	Nontechnical Electives[2, 4]	3
Nontechnical Electives[2, 4]	3		
Total	18	*Total*	17

Fourth Year[1]

Physics 371—Light	4	Physics 372—Light	2
Physics 381 or 382—Atomic Physics	3	Physics 374—Light Laboratory	2
Physics 344—Vacuum Tubes[5] *or* Technical or Nontechnical Electives	4	Chemistry 240—Physical Chemistry	3
Technical or Nontechnical Electives[4]	3	Technical or Nontechnical Electives[4]	9
Nontechnical Electives[2]	3		
Total	17	*Total*	16

[1] *Students wishing to emphasize chemistry* are advised to elect Chem. 110 and 124 in the second year and may choose Chem. 234 or other advanced chemistry in place of E.E. 320 and 321.
[2] It is suggested that the nontechnical electives be chosen from the social sciences (for example, anthropology, history, political science, psychology, and sociology) or the humanities (for example, art, classics, English, humanities, music, and philosophy).
[3] Math. 341-342 or Math. 347-348 may be substituted for Math. 343 and 345.
[4] Advanced Military may be substituted for 6 hours of "nontechnical electives" and 6 hours of "technical or nontechnical electives."
[5] *Students desiring to emphasize E.E.* may elect E.E. 340-341 and E.E. 349 instead of Physics 343-344. These students should register in E.E. 351 concurrently with one of the above courses. This allows E.E. 355 to be taken the second semester of the senior year.

General Engineering

This curriculum is intended for the student who wishes to secure a well rounded education in engineering principles and their applications. At the same time he may secure some knowledge in a secondary field of endeavor, such as business, sales, technical journalism, or engineering geology. Each student is required to take a minimum of fifteen hours in one of the latter fields by selecting the desired subjects from the lists which follow the curriculum.

Opportunity is also provided in General Engineering for the student to secure a basic liberal education in social and humanistic studies.

The Department of General Engineering teaches the basic courses in Engineering Drawing and Engineering Geometry for all engineers. In addition, it provides a series of elective courses some of which are technical and some non-technical. These are listed in the catalog under General Engineering.

Teaching Staff

Professors: R. P. Hoelscher (Head of Department), S. G. Hall, H. H. Jordan (Emeritus), B. O. Larson, J. E. Pearson, S. H. Pierce (Associate Dean of the College), L. A. Rose, C. H. Springer, L. D. Walker.

Associate Professor: W. W. Hay (Cooperating).

Assistant Professors: R. P. Borri, R. S. Crossman (Emeritus), J. S. Dobrovolny, E. D. Ebert, A. G. Friederich, W. L. Shick.

Instructors: H. J. Bokenkamp, P. S. Chiado, T. C. Hartley, R. A. Jewett, G. E. Martin, R. W. McDonald, H. C. Nelson, F. L. Spalding, J. R. Tague, Grace Wilson.

Curriculum in General Engineering

For the Degree of Bachelor of Science in General Engineering

First Year

Common Program for Freshmen (page 87)

Second Year

FIRST SEMESTER	HOURS	SECOND SEMESTER	HOURS
Econ. 108—Elements of Economics	3	C.E. 115—General Surveying	3
Math. 143—Calculus	5	Physics 108—General Physics	4
M.E. 182—Manufacturing Processes	3	Speech 101—Principles of Speech	3
Physics 107—General Physics	4	T.A.M. 156—Statics and Dynamics	5
Physical Education	1	Physical Education	1
Military (men)	1	Military (men)	1
Total	17	*Total*	17

Third Year

Civil Engineering Option

FIRST SEMESTER	HOURS	SECOND SEMESTER	HOURS
E.E. 206—D.C. and A.C. Circuits	3	C.E. 261—Structural Analysis	4
E.E. 207—D.C. and A.C. Circuits Laboratory	1	E.E. 208—D.C. and A.C. Apparatus	3
G.E. 111—Advanced Drafting	2	E.E. 209—D.C. and A.C. Apparatus Laboratory	1
T.A.M. 221—Resistance of Materials	3	T.A.M. 232—Fluid Mechanics	3
T.A.M. 223—Resistance of Materials Laboratory	1	T.A.M. 234—Fluid Mechanics Laboratory	1
Technical or Nontechnical Electives[1]	9	Technical or Nontechnical Electives[1]	6
Total	19	*Total*	18

Mechanical Engineering Option

E.E. 206—D.C. and A.C. Circuits	3	E.E. 208—D.C. and A.C. Apparatus	3
E.E. 207—D.C. and A.C. Circuits Laboratory	1	E.E. 209—D.C. and A.C. Apparatus Laboratory	1
G.E. 112—Advanced Drafting	2	M.E. 221—Mechanics of Machinery	5
T.A.M. 221—Resistance of Materials	3	T.A.M. 232—Fluid Mechanics	3
T.A.M. 223—Resistance of Materials Laboratory	1	T.A.M. 234—Fluid Mechanics Laboratory	1
Technical or Nontechnical Electives[1]	9	Technical or Nontechnical Electives[1]	6
Total	19	*Total*	19

Fourth Year

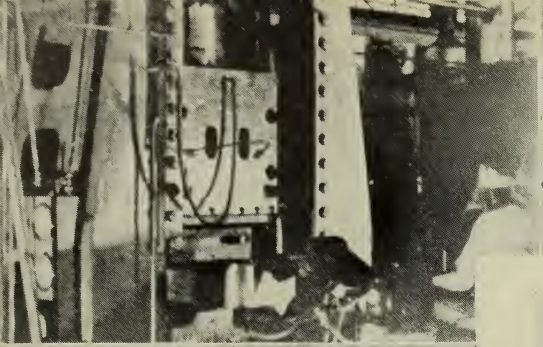
Civil Engineering Option

C.E. 262—Structural Analysis	3	C.E. 264—Structural Design	5
C.E. 263—Elementary Structural Design	2	G.E. 292—Engineering Law	3
G.E. 299—Inspection Trip	0	M.E. 263—Power Plant Equipment	5
M.E. 202—Thermodynamics	3	Technical or Nontechnical Electives[1]	5
Met. E. 230—Engineering Metallurgy	3		
Technical or Nontechnical Electives[1]	7		
Total	18	*Total*	18

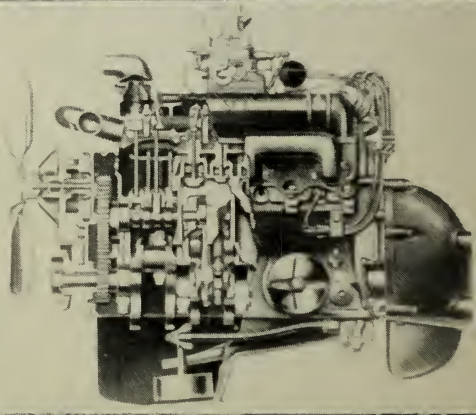
Mechanical Engineering Option

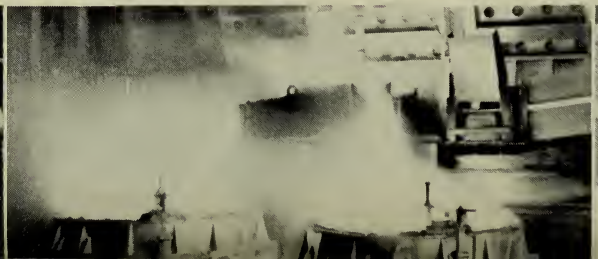
C.E. 260—Structural Engineering	3	G.E. 292—Engineering Law	3
G.E. 299—Inspection Trip	0	M.E. 263—Power Plant Equipment	5
M.E. 202—Thermodynamics	3	M.E. 271—Design of Machine Elements	3
M.E. 224—Design of Machine Elements	3	Technical or Nontechnical Electives[1]	6
Met. E. 230—Engineering Metallurgy	3		
Technical or Nontechnical Electives[1]	6		
Total	18	*Total*	17

[1] Of these electives 15 hours shall be selected from one of the suggested fields of concentration, or other combinations approved by the department. Up to 12 hours of advanced military courses may be used for nontechnical electives, otherwise a minimum of 6 hours must be from the social-humanistic stem.



THROUGH DRAWINGS, IDEAS BECOME REALITIES





SUGGESTED FIELDS OF CONCENTRATION

Business Combination

Accy. 201—Fundamentals of Accounting....3
Econ. 170—Elements of Statistics....3
Econ. 248—Personnel Administration.3
Econ. 257—Corporation Finance.....3
Econ. 260—Economics of Insurance..3
Econ. 271—Business Statistics.....3
I.E. 232—Methods—Time Analysis..3
M.E. 233—Industrial Quality Control.3
Rhet. 151—Business Letter Writing..3

Sales Combination

Accy. 201—Fundamentals of Accounting....3
G.E. 210—Industrial Production Illustration....3
Mktg. 101—Principles of Marketing..3
Mktg. 271—Salesmanship....2
Mktg. 281—Introduction to Advertising....3
Mktg. 372—Advanced Salesmanship..2
Psych. 145—Industrial Psychology...3
Rhet. 151—Business Letter Writing...3

Technical Journalism Combination

G.E. 210—Industrial Production Illustration....3
G.E. 216—Engineering Reports....3
Journ. 204—Typography....2
Journ. 223—Fundamentals of Photo-Journalism....3
Journ. 227—Magazine Article Writing....3
Journ. 328—Industrial Publications..2
Journ. 351—Graphic Production Processes....3
Psych. 145—Industrial Psychology...3
Rhet. 151—Business Letter Writing..3

Engineering Geology Combination

G.E. 205—Applied Descriptive Geometry in Geological Problems...2
G.E. 216—Engineering Reports....3
Geol. 102—Historical Geology....4
Geol. 130—Mineralogy for Engineers..3
Geol. 150—Geology for Engineers....3
Geol. 311—Structural Geology....4
Geol. 320—Invertebrate Paleontology.4
Geol. 321—Stratigraphy....4

Students with other well defined interests may arrange different combinations by consultation with and approval of the departmental adviser.

Industrial Engineering

This curriculum is designed to give the student the basic principles and practical aspects of production engineering and control of manufacturing operations. Areas of study include product and process planning, work methods and measurements, and the coordination of these activities with plant layout and material flow. The breadth of training is sufficient to equip the graduate for future responsibility in production management.

In addition to specific courses in industrial engineering, the curriculum includes an extensive background in mechanical engineering, the first two years being common in the two programs. The final four semesters contain the full core of machine design and an abbreviated core of power courses taken by all mechanical engineering students. Within the framework of electives, sequences of courses may be selected to allow the student to emphasize somewhat either the production-tool engineering phase or the management phase of industrial engineering. The curriculum is administered by the Department of Mechanical Engineering.

The Time and Motion Study laboratory

Many courses are available at the graduate level for those students who desire to obtain more background in any phase of industrial engineering. These courses may lead to a Master of Science or Doctor of Philosophy degree.

Teaching Staff (See Mechanical Engineering)

Curriculum in Industrial Engineering

For the Degree of Bachelor of Science in Industrial Engineering

First Year

Common Program for Freshmen (page 87)

D.G.S. 111-112, 4 credit hours each, may be taken in place of Rhetoric and Composition, each 3 hours. The additional 2 hours may be used for nontechnical electives in the second year.

Second Year

FIRST SEMESTER	HOURS	SECOND SEMESTER	HOURS
M.E. 183—Materials Casting, *or* M.E. 184—Metal Processing	3	M.E. 184—Metal Processing, *or* M.E. 183—Materials Casting	3
Econ. 108—Elements of Economics	3	G.E. 112—Advanced Drafting for Mechanical Engineers	2
Math. 143—Calculus	5	Physics 108—Heat, Sound, Light	4
Physics 107—Electricity and Magnetism, Modern Physics	4	T.A.M. 211—Analytical Mechanics (Dynamics)	3
T.A.M. 150—Analytical Mechanics (Statics)	2	T.A.M. 221—Resistance of Materials	3
Physical Education	1	Nontechnical Electives	2
Military (men)	1	Physical Education	1
		Military (men)	1
Total	19	*Total*	19

Third Year

FIRST SEMESTER	HOURS	SECOND SEMESTER	HOURS
I.E. 237—Manufacturing Organization and Operation	3	I.E. 232—Methods-Time Analysis	3
M.E. 209—Thermodynamics and Heat Transfer	3	M.E. 208—Mechanical Engineering Laboratory	3
M.E. 221—Mechanics of Machinery	5	M.E. 224—Design of Machine Elements	3
Math. (new)—Statistics for Engineers	3	M.E. 234—Heat Treatment of Metals	3
T.A.M. 223—Resistance of Materials Laboratory	1	Accy. 206—Cost Accounting for Engineers	3
Technical or Nontechnical Electives	3	Nontechnical Electives	3
Total	18	*Total*	18

Fourth Year

I.E. 282—Process Planning and Tool Design	3	I.E. 283—Plant Layout and Materials Handling	3
I.E. 299—Inspection Trip	0	I.E. 291—Seminar	1
E.E. 210—Electrical Equipment and Application	4	I.E. 357—Safety Engineering	3
E.E. 211—Electrical Equipment Laboratory	1	Technical Electives[1]	6
M.E. 271—Design of Machine Elements	3	Nontechnical Electives	3
Technical Electives	3		
Nontechnical Electives	3		
Total	17	*Total*	16

[1] Three hours must be taken from I.E. 286 or M.E. 288.

The fourth-year technical electives must be selected from courses in the 300-series in Engineering or Mathematics, or from the following courses:

	HOURS
I.E. 286. Production Coordination	3
I.E. 287. Job Evaluation and Wage Incentives	3
I.E. 297. Experimental Investigation	3
I.E. 298. Thesis	3
M.E. 284. Welding Engineering	3
M.E. 288. Production Processes and Inspection	3

Mechanical Engineering

This curriculum presents the theory and practice of the generation, transmission, and utilization of power, and the theory of operation, design, testing, and construction of all types of machines. In the laboratories, emphasis is placed on the engineering and economic principles of machine design, operation, performance, and construction and on the problems of production management.

The curriculum provides training in the basic courses of science, mathematics, design, power, production, and engineering fundamentals, with electives which the student may select during the junior and senior years, depending upon his interest in any of the phases of heat power, machine design, or industrial production. These elective courses do not make a specialist of the student but rather give a wider background and

illustrate the application of fundamentals previously learned to the field of his particular interest.

For those students who desire to obtain more background in any phase, many courses are offered at the graduate level in mechanical engineering which may lead to a Master of Science or Doctor of Philosophy degree.

Teaching Staff

Professors: N. A. Parker (Head of Department), E. L. Broghamer, C. H. Casberg (Emeritus), W. N. Espy, J. R. Fellows, C. W. Ham (Emeritus), J. A. Henry, W. L. Hull, S. Konzo, H. H. Korst, D. H. Krans (on leave), A. P. Kratz (Emeritus), R. F. Larson, E. D. Luke, R. J. Martin, J. C. Miles, J. A. Polson (Emeritus), D. G. Ryan, W. H. Severns (on leave), F. Seyfarth, K. J. Trigger, A. C. Willard (Emeritus).

Associate Professors: B. T. Chao, D. H. Cole, L. E. Doyle, C. D. Greffe, G. W. Harper, E. F. Hebrank, J. L. Leach, L. C. Pigage, C. E. Shubert, C. J. Starr (Emeritus), L. M. Zubko.

Assistant Professors: H. D. Bareither, J. W. Bayne, J. R. Carroll, C. H. McClay, D. E. McFeron, D. H. Offner, T. W. Price, E. I. Radzimovsky, G. F. Schrader, R. P. Strout, J. L. Whisenand.

Lecturer: I. L. Reis.

Instructors: C. E. Derrough, R. H. Page, M. B. Singer, W. F. Stoecker, A. D. Wright (Emeritus).

Assistants: H. O. Barthel, I. M. Bienias, G. M. Cabble, C. H. Long, M. J. Nee.

Curriculum in Mechanical Engineering

For the Degree of Bachelor of Science in Mechanical Engineering

First Year

Common Program for Freshmen (page 87)

D.G.S. 111-112, 4 credit hours each, may be taken in place of Rhetoric and Composition, each 3 hours. The additional 2 hours may be used for nontechnical electives in the second year.

Second Year

FIRST SEMESTER	HOURS	SECOND SEMESTER	HOURS
M.E. 183—Materials Casting, *or* M.E. 184—Metal Processing	3	M.E. 184—Metal Processing, *or* M.E. 183—Materials Casting	3
Econ. 108—Elements of Economics	3	G.E. 112—Advanced Drafting for Mechanical Engineers	2
Math. 143—Calculus	5	Physics 108—Heat, Sound, Light	4
Physics 107—Electricity and Magnetism, Modern Physics	4	T.A.M. 211—Analytical Mechanics (Dynamics)	3
T.A.M. 150—Analytical Mechanics (Statics)	2	T.A.M. 221—Resistance of Materials	3
Physical Education	1	Nontechnical Electives	2
Military (men)	1	Physical Education	1
		Military (men)	1
Total	19	*Total*	19

The Mechanical Engineering Building

Third Year

FIRST SEMESTER	HOURS	SECOND SEMESTER	HOURS
M.E. 205—Thermodynamics	3	M.E. 206—Thermodynamics	3
M.E. 221—Mechanics of Machinery	5	E.E. 208—D.C. and A.C. Apparatus	3
E.E. 206—D.C. and A.C. Circuits	3	E.E. 209—D.C. and A.C. Apparatus Laboratory	1
E.E. 207—D.C. and A.C. Circuits Laboratory	1	M.E. 212—Heat Transmission and Gas Dynamics	4
Math. 345—Differential Equations *or* Math. (new)—Statistics for Engineers	3	M.E. 224—Design of Machine Elements	3
T.A.M. 223—Resistance of Materials Laboratory	1	Nontechnical Electives	3
Technical or Nontechnical Electives	3		
Total	19	*Total*	17

Fourth Year

M.E. 234—Heat Treatment of Metals	3	M.E. 264—Advanced Heat Power Laboratory	3
M.E. 263—Application of Energy Concepts to Power Processes	5	M.E. 291—Seminar	1
M.E. 271—Design of Machine Elements	3	I.E. 237—Manufacturing Organization and Operation	3
M.E. 299—Inspection Trip	0	Technical Electives[1]	6
Technical Electives	3	Nontechnical Electives	3
Nontechnical Electives	3		
Total	17	*Total*	16

[1] Three hours must be taken from M.E. 260, M.E. 273, or I.E. 282.

The fourth year technical electives must be selected from courses in the 300-series in Engineering or Mathematics, or from the following courses:

		HOURS
I.E. 282.	Process Planning and Tool Design	3
M.E. 256.	Internal Combustion Engines	3
M.E. 257.	Gas Turbines	3
M.E. 258.	Combustion Engine and Turbine Laboratory	3
M.E. 259.	Refrigeration	3
M.E. 260.	Heating, Ventilating, and Air-Conditioning	3
M.E. 261.	Heating, Ventilating, and Air-Conditioning Design	3
M.E. 272.	Analytical Design of High-Speed Engines	3
M.E. 273.	Machine Design	3
M.E. 284.	Welding Engineering	3
M.E. 288.	Production Processes and Inspection	3
M.E. 297.	Experimental Investigation	3
M.E. 298.	Thesis	3

Metallurgical Engineering

The curriculum is divided into an industrial option and a physical metallurgy option. The industrial option is designed to give thorough instruction in the engineering fundamentals of the three main divisions of metallurgy — chemical, mechanical, and physical — with the emphasis placed on the third. After the first two years, which are essentially the same as in all engineering curricula, the technical courses provide specialized work in ferrous and nonferrous process metallurgy, ferrous and nonferrous metallography, physics of metals, electrometallurgy, heat treatment, and alloy steels. Courses outside the department are specified, to give a balanced engineering background.

Metallography laboratory — students learn to prepare specimens and interpret the microstructure of metals

The physical metallurgy option is designed to meet the needs of students who are particularly interested in training for work in fundamental research in metals and alloys. It is expected that students enrolled in this program will follow their undergraduate studies with graduate work. Only those with an excellent record in the first two years of undergraduate work are admitted to this option.

In both options, a large number of elective hours is provided to allow a selection of technical and nontechnical courses to broaden the student's field of knowledge.

Teaching Staff

Professors: W. R. Chedsey (Acting Head of Department), P. A. Beck.
Associate Professors: E. J. Eckel, A. C. Forsyth, B. G. Ricketts, C. A. Wert.
Assistant Professor: R. W. Bohl.

Curriculum in Metallurgical Engineering

For the Degree of Bachelor of Science in Metallurgical Engineering

First Year

Common Program for Freshmen (page 87)

Second Year

FIRST SEMESTER	HOURS	SECOND SEMESTER	HOURS
Chem. 123—Quantitative Analysis	5	Met. E. 150—Introduction to Metallurgy	3
Math. 143—Calculus	5	Physics 108—Heat, Sound, Light	4
Physics 107—Electricity and Magnetism, Modern Physics	4	T.A.M. 154—Analytical Mechanics (Statics and Dynamics)	4
Nontechnical Electives	3	Nontechnical Electives	3
Physical Education	1	Physical Education	1
Military (men)	1	Military (men)	1
Total	19	*Total*	16

Third Year

Industrial Metallurgy Option

Met. E. 201—Principles of Physical Metallurgy	3	Met. E. 208—Ferrous Metallography	3
Met. E. 203—Principles of Physical Metallurgy Laboratory	1	Met. E. 210—Ferrous Metallography Laboratory	3
Met. E. 205—Metallurgy of Iron and Steel	3	Met. E. 214—Electrometallurgy	2
Met. E. 207—Metallurgical Calculations	2	Met. E. 216—Electrometallurgy Laboratory	1
Cer. E. 221—Pyrometry	2	Met. E. 218—Physics of Metals	3
Chem. 245—Elementary Physical Chemistry	3	Chem. 246—Elementary Physical Chemistry	3
Nontechnical Electives[1]	3	T.A.M. 221—Resistance of Materials	3
		T.A.M. 223—Resistance of Materials Laboratory	1
Total	17	*Total*	19

PHYSICAL METALLURGY OPTION

FIRST SEMESTER	HOURS	SECOND SEMESTER	HOURS
Met. E. 201—Principles of Physical Metallurgy	3	Met. E. 208—Ferrous Metallography	3
Met. E. 203—Principles of Physical Metallurgy Laboratory	1	Met. E. 210—Ferrous Metallography Laboratory	3
Met. E. 205—Metallurgy of Iron and Steel	3	Met. E. 218—Physics of Metals	3
Cer. E. 221—Pyrometry	2	Chem. 246—Elementary Physical Chemistry	3
Chem. 245—Elementary Physical Chemistry	3	Math. 345—Differential Equations and Orthogonal Functions	3
Math. 343—Advanced Calculus	3	Technical or Nontechnical Electives[1]	3
Nontechnical Electives[1]	3		
Total	18	*Total*	18

Fourth Year

INDUSTRIAL METALLURGY OPTION

Met. E. 251—Nonferrous Metallography	3	Met. E. 256—Mechanical Metallurgy	3
Met. E. 253—Nonferrous Metallography Laboratory	3	Met. E. 258—Alloy Steels	3
Met. E. 255—Nonferrous Production Metallurgy	3	Met. E. 260—Advanced Physical Metallurgy Laboratory	3
Met. E. 295—Metallurgical Seminar	1	Met. E. 296—Metallurgical Seminar	1
Met. E. 299—Inspection Trip	0	E.E. 204—Applications of Electrical Equipment	2
E.E. 202—D.C. and A.C. Circuits and Machines	2	E.E. 205—Electrical Equipment Laboratory	1
E.E. 203—D.C. and A.C. Circuits and Machines Laboratory	1	Technical or Nontechnical Electives[1]	5
T.A.M. 323—Advanced Laboratory in Materials Testing	3		
Technical or Nontechnical Electives[1]	2		
Total	18	*Total*	18

PHYSICAL METALLURGY OPTION

Met. E. 251—Nonferrous Metallography	3	Met. E. 260—Advanced Physical Metallurgy Laboratory	3
Met. E. 253—Nonferrous Metallography Laboratory	3	Met. E. 296—Metallurgical Seminar	1
Met. E. 295—Metallurgical Seminar	1	Chem. 397—Radiochemistry	2
Met. E. 299—Inspection Trip	0	Chem. 398—Radiochemistry Laboratory	1
Met. E. 308—Metallurgical Kinetics and Thermodynamics	3	Physics 342—Electricity and Magnetism	4
Physics 281—Intermediate Atomic Physics	3	Technical Electives (in Physics Department)	3
Physics 341—Electricity and Magnetism	4	Technical or Nontechnical Electives[1]	5
Total	17	*Total*	19

[1] Six hours of Advanced Military may be substituted for 6 hours of electives.

Metal pouring in the Metallurgical Engineering laboratory

Mining Engineering

This curriculum treats the fundamental engineering problems involved in extracting coal and minerals from the earth, and in the preliminary preparation of coal and minerals for use in our civilization. Specialized courses include prospecting, mine surveying, mining methods, mine examination, mine ventilation, coal preparation, mineral dressing, mine administration, and the design of mine plants. Interwoven throughout the curriculum is a series of required courses which provide the broad engineering background demanded by the mining industries and which are largely responsible for the success with which the University of Illinois is meeting that increasing demand.

Since many graduating mining engineers are finding employment in the petroleum production industry, an option in this field is offered as a curriculum in mining engineering. This program is designed to give the student a strong background in geology, fundamental engineering and science, together with petroleum geology and petroleum production engineering.

Teaching Staff

Professors: W. R. Chedsey (Acting Head of Department), G. B. Clark, W. H. Voskuil.
Assistant Professor: R. G. Wuerker.

Curriculum in Mining Engineering

For the Degree of Bachelor of Science in Mining Engineering

First Year

Common Program for Freshmen (page 87)

Second Year

General Option

FIRST SEMESTER	HOURS	SECOND SEMESTER	HOURS
Min. E. 151—Elements of Mining	2	Min. E. 152—Fuels	3
C.E. 115—General Surveying	3	Min. E. 154 —Mine Surveying	2
Math. 143—Calculus	5	Econ. 108—Elements of Economics	3
Geol. 150—Geology for Engineers	3	Geol. 130—Mineralogy for Engineers	3
Physics 107—Electricity and Magnetism, Modern Physics	4	Physics 108—Heat, Sound, Light	4
Physical Education	1	T.A.M. 150—Analytical Mechanics (Statics)	2
Military (men)	1	Physical Education	1
		Military (men)	1
Total	19	*Total*	19

Summer

First and Second Weeks

Min. E 205—Summer Mine Surveying ..... 2 hours

Petroleum Option

Physics 107—Electricity, Magnetism, and Modern Physics	4	Chem. 123—Quantitative Analysis for Engineers	5
Math. 143—Calculus	5	Physics 108—Heat, Sound, and Light	4
Geol. 130—Mineralogy for Engineers	3	Geol. 150—Geology for Engineers	3
Min. E. 151—Elements of Mining	2	T.A.M. 150—Analytical Mechanics (Statics)	2
C.E. 115—General Surveying	3	Min. E. 154—Mine Surveying	2
Physical Education	1	Physical Education	1
Military (men)	1	Military (men)	1
Total	19	*Total*	18

Summer

First and Second Weeks

Min. E. 205—Summer Mine Surveying ..... 2 hours

Third Year

General Option

Min. E. 201—Prospecting and Exploration of Mineral Deposits	3	Min. E. 202—Mineral Dressing	3
E.E. 306—D.C. and A.C. Circuits	3	E.E. 308—D.C. and A.C. Apparatus	3
E.E. 307—D.C. and A.C. Circuits Laboratory	1	E.E. 309—D.C. and A.C. Apparatus Laboratory	1
T.A.M. 211—Analytical Mechanics	3	M.E. 201—Steam, Air, and Gas Machinery	3
T.A.M. 221—Resistance of Materials	3	T.A.M. 232—Fluid Mechanics	3
T.A.M. 223—Resistance of Materials Laboratory	1	T.A.M. 234—Fluid Mechanics Laboratory	1
Nontechnical Electives[1]	3	Nontechnical Electives[1]	3
Total	17	*Total*	17

PETROLEUM OPTION

FIRST SEMESTER	HOURS	SECOND SEMESTER	HOURS
Chem. 245—Elementary Physical Chemistry	3	E.E. 208—D.C. and A.C. Apparatus	3
E.E. 206—D.C. and A.C. Circuits	3	E.E. 209—D.C. and A.C. Apparatus Laboratory	1
E.E. 207—D.C. and A.C. Circuits Laboratory	1	Geol. 311—Structural Geology	4
Min. E. 201—Prospecting and Exploration of Mineral Deposits	3	M.E. 201—Mechanical Power Equipment	3
Geol. 102—Historical Geology	4	T.A.M. 232—Fluid Mechanics	3
T.A.M. 211—Analytical Mechanics	3	T.A.M. 234—Fluid Mechanics Laboratory	1
		Nontechnical Electives[1]	3
Total	17	*Total*	18

Fourth Year

GENERAL OPTION

Min. E. 251—Mine Administration and Valuation	3	Min. E. 258—Mining Design	3
Min. E. 253—Principles of Mining Methods	4	Min. E. 262—Mine Ventilation	3
Min. E. 257—Haulage, Hoisting, and Pumping	4	Min. E. 396—Seminar	1
Min. E. 255—Coal Preparation	1	Met. E. 150—Introduction to Metallurgy, *or* Met. E. 230—Engineering Metallurgy	3
Min. E. 299—Inspection Trip	0	Technical or Nontechnical Electives[1]	6
Min. E. 351—Geophysics of Mining	3		
Technical or Nontechnical Electives[1]	2		
Total	17	*Total*	16

PETROLEUM OPTION

Min. E. 371—Petroleum Production	3	Min. E. 251—Mine Administration and Valuation	3
Geol. 246—Applied Petroleum Geology	3	Min. E. 372—Petroleum Production	3
Min. E. 351—Geophysical Prospecting	3	Geol. 247—Applied Petroleum Geology	3
Min. E. 299—Inspection Trip	0	Min. E. 396—Seminar	1
T.A.M. 221—Resistance of Materials	3	Technical or Nontechnical Electives[1]	7
T.A.M. 223—Resistance of Materials Laboratory	1		
Nontechnical Electives[1]	3		
Total	16	*Total*	17

[1] Six hours of Advanced Military may be substituted for 6 hours of electives.

Sanitary Engineering

The sanitary engineer is basically a civil engineer with special knowledge in chemical and biological sciences. Hence the first three years of the two curricula are basically the same, sanitary engineering covering work in public health engineering and in chemistry not required in civil engineering. The needed time is obtained by omitting courses in electrical engineering or electives from the sanitary engineering curriculum. In the last year of this curriculum greater stress is placed on water supply and on sewerage, a course is required in organic chemistry and in

public health engineering, and time for an elective is available to those who have had the basic course in public health engineering.

Teaching Staff (See Civil Engineering)

Curriculum in Sanitary Engineering

For the Degree of Bachelor of Science in Sanitary Engineering

First Year

Common Program for Freshmen (page 87)

Second Year

FIRST SEMESTER	HOURS	SECOND SEMESTER	HOURS
C.E. 105—Plane Surveying	2	C.E. 106—Surveying	3
C.E. 160—Building Construction	3	Geol. 150—Engineering Geology	3
Math. 143—Calculus	5	Physics 108—Heat, Sound, Light	4
Physics 107—Electricity and Magnetism, Modern Physics	4	T.A.M. 211—Analytical Mechanics (Dynamics)	3
T.A.M. 150—Analytical Mechanics (Statics)	2	Nontechnical Electives	3
Physical Education	1	Physical Education	1
Military (men)	1	Military (men)	1
Total	18	*Total*	18

Summer Surveying Camp (C.E. 207—5 hours) follows Second Year[1]

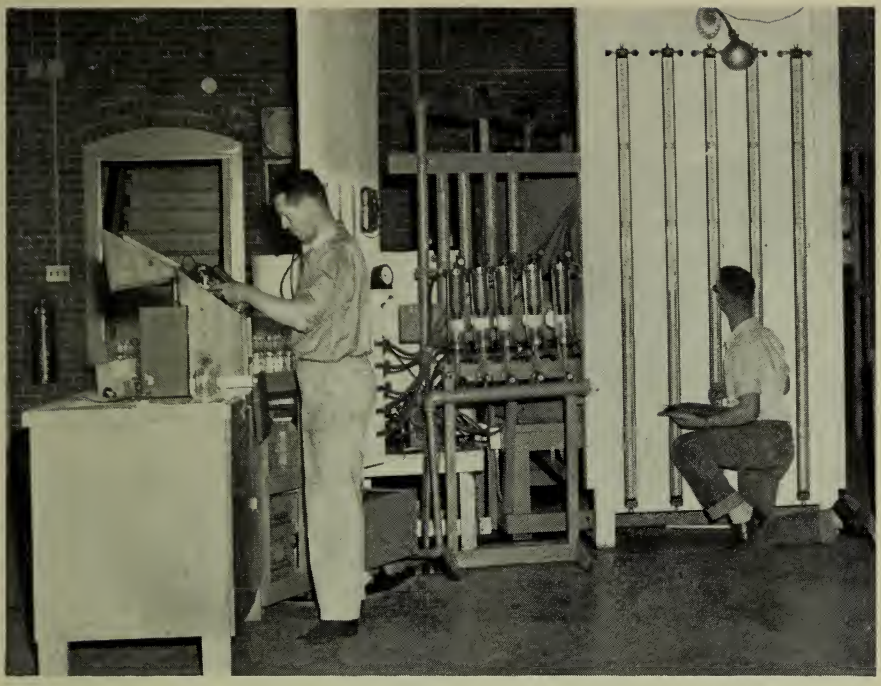
Third Year

C.E. 230—Soils and Bituminous Materials	2	Chem. 122—Elementary Quantitative Analysis	5
C.E. 235—Plain Concrete	2	C.E. 262—Structural Analysis	3
C.E. 261—Structural Analysis	4	C.E. 263—Elementary Structural Design	2
Bacteriology 104—Introductory Bacteriology	5	M.E. 201—Mechanical Power Equipment	3
T.A.M. 221—Resistance of Materials	3	T.A.M. 232—Fluid Mechanics	3
T.A.M. 223—Resistance of Materials Laboratory	1	T.A.M. 234—Fluid Mechanics Laboratory	1
Total	17	*Total*	17

Fourth Year

C.E. 220—Highways	3	Chem. 132—Elementary Organic Chemistry	3
C.E. 240—Water Supply	4	C.E. 241—Sewerage	3
C.E. 370—Foundations and Retaining Walls	3	C.E. 264—Structural Design	5
C.E. 295—Professional Practice	0	C.E. 296—Professional Practice	0
C.E. 299—Inspection Trip	0	C.E. 345—Public Health Engineering	3
C.E. 344—Water and Sewage Treatment	5	Nontechnical Electives	3
Total	15	*Total*	17

[1] Students transferring to civil engineering or sanitary engineering with advanced standing, who have not completed all requirements in surveying, are required to attend the summer surveying camp at Camp Rabideau in northern Minnesota.



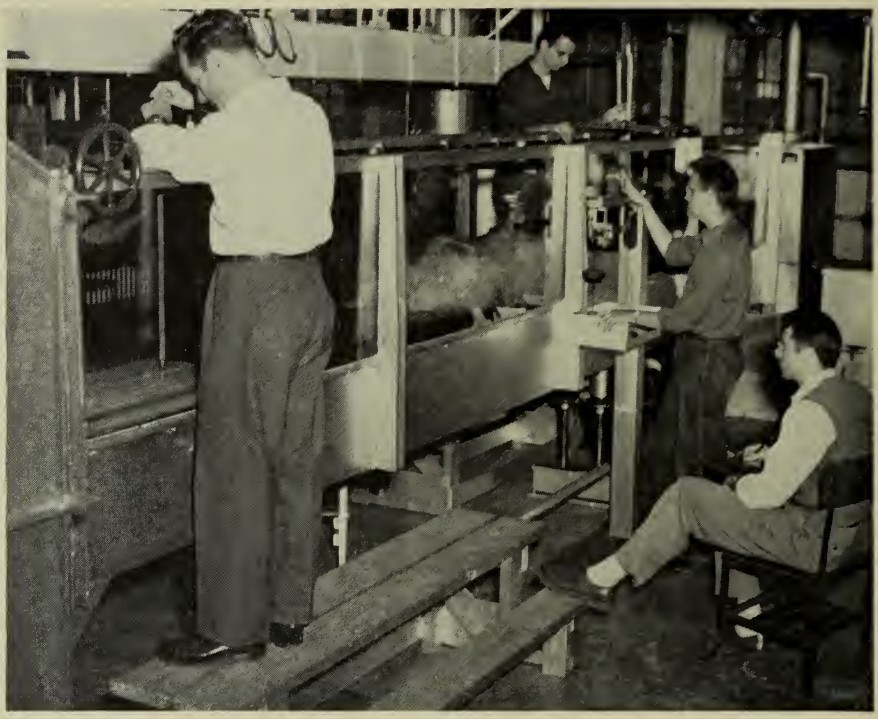
Water purification studies in Sanitary Engineering

Theoretical and Applied Mechanics

The Department of Theoretical and Applied Mechanics offers courses required in the curricula of the degree-granting departments. The purpose of the courses is training in analyzing and solving basic engineering problems in the design, construction, and operation of structures and machines. This is accomplished by the use of mathematics and the principles of mechanics, supplemented by appropriate experimental work, which is correlated closely with the classroom instruction. Thus, as the name of the department implies, the study of mechanics is both "theoretical" and "applied."

In the materials laboratory are studied the resistance to loads and the deformational behavior of materials such as steel, aluminum, wood, and concrete by loading them in tension or compression, in bending and in twisting. The results of the tests indicate the various properties possessed by these materials and form the basis for determining how they can be used in the design and construction of engineering structures and machines.

In the hydraulics and fluid mechanics laboratory, experiments are performed on the flow of water, oil, and air in pipes and on the flow of



The hydraulic jump is studied in a glass-walled tilting flume

water in open channels. Several types of viscometers are used to determine the viscosity of fluids; the operation of various pumps and turbines is also studied.

In addition to the courses required for all engineers, advanced courses are offered, which may be selected as electives in the junior or senior years. The department also offers a wide selection of courses for graduate study and grants both the degrees of Master of Science and Doctor of Philosophy in Engineering.

Staff

Professors: T. J. Dolan (Head of Department), W. E. Black, W. L. Collins, J. O. Draffin (Emeritus), M. L. Enger (Emeritus), N. E. Ensign (Emeritus), P. G. Jones, H. L. Langhaar, W. M. Lansford, H. F. Moore (Emeritus), W. J. Putnam, H. J. Schrader, W. L. Schwalbe, F. B. Seely (Emeritus), J. O. Smith, A. M. Freudenthal (Res. Consultant).

Associate Professors: C. E. Bowman, R. E. Cramer, W. N. Findley, C. E. Kesler, O. M. Sidebottom, G. M. Sinclair, M. C. Steele.

Assistant Professors: A. P. Boresi, R. L. Brown, M. E. Clark, H. T. Corten, C. W. Dollins, H. M. Fitch, R. S. Jensen, M. C. Stippes, I. M. Viest, H. R. Wetenkamp, W. J. Worley.

Instructors: D. O. Brush, T. M. Elsesser, F. J. Stanek, G. A. Wempner.

Associate: F. G. Bauling.

Assistants: T. Dimoff, G. Khosla, D. E. Martin, P. Mathur.

X. EXTRACURRICULAR ACTIVITIES

One of the foremost questions in a student's mind is: Why take part in extracurricular activities? I'm going to school to study, not to waste time. The answer to this question is fairly simple. Important though the gaining of knowledge and the development of your mental ability are, they are not the sole aims of education. Equally important is the growth of a personality which will inspire confidence and develop friendships among your colleagues. By accomplishing this you also contribute to good citizenship in a democracy.

The question of how to develop a pleasing personality can be answered in several ways. One method, of course, is to read books on the subject and to study successful men. A generally more satisfying method, however, is to associate with your fellow students in one of the numerous extracurricular activities.

A great many engineering students feel that they don't have enough time for extracurricular activities. They say that you can't participate in these activities and still do justice to your studies. This idea is very common, but wrong. Actually, the attitudes you develop by participating in the activity help you to study more effectively. This in turn more than makes up for the time you will spend upon the activity. In addition, you learn a great deal about how people's minds work; and, increasingly in your professional experience, a knowledge of human as well as material processes becomes essential. In fact, extracurricular activities provide a laboratory in human relations.

Finally, an extracurricular activity gives you a means of relaxing — something that nearly everyone needs. Like a hobby in later life, an extracurricular activity provides a release from the strains and tensions of the day-to-day grind.

STUDENT PROFESSIONAL SOCIETIES

With the exception of the recent ones, practically all the societies started as clubs, and were later chartered as student branches by the parent national societies. The present list includes:

The American Ceramic Society
The American Foundrymen's Society
The American Institute of Electrical Engineers
— Institute of Radio Engineers

The American Institute of Chemical Engineers
The American Society of Agricultural Engineers
The American Society of Civil Engineers
The Illuminating Engineers Society
The Institute of Aeronautical Sciences
The Institute of Traffic Engineers
The Mineral Industries Society
The Society of Automotive Engineers
The American Society of Mechanical Engineers
The American Institute of Metallurgical Engineers
The Physics Society

As you can see, each of these societies is related to a particular field of work. With slight differences, nearly all are organized to promote interest in the parent group, to advance professional spirit and ethics, and to provide a meeting place for students, faculty, and eminent practicing engineers. The monthly or bi-weekly meetings ordinarily have programs featuring students or prominent speakers. Most societies also sponsor picnics, smokers, and ball games throughout the year. Membership, which is entirely voluntary, should be seriously considered at any time after your freshman year.

An Aeronautical Engineering class working with the small wind tunnel

HONOR FRATERNITIES

In addition to the professional societies, many departments are also represented by the following honor fraternities, two of which cross departmental boundaries to include all engineers:

Tau Beta Pi — all-engineering
Sigma Tau — all-engineering
Eta Kappa Nu — Electrical Engineering
Keramos — Ceramic Engineering
Pi Tau Sigma — Mechanical Engineering
Chi Epsilon — Civil Engineering
Alpha Sigma Mu — Metallurgical Engineering
Phi Lambda Upsilon — Chemical Engineering
Sigma Xi — Scientific Research
Sigma Gamma Tau — Aeronautical Engineering
Mu San — Sanitary Engineering

Most of these have national affiliations. Since they are organized primarily to recognize and promote scholarship, members are selected by ballot and must have a minimum scholastic standing to be selected.

THE ENGINEERING COUNCIL

The Engineering Council coordinates the activities of the professional engineering societies, promotes the interest of all engineering students in extracurricular activities, and supervises such functions as St. Pat's Ball and the Engineering Open House. The present constitution went into effect in 1947 although similar groups have been in operation since 1894. The Council consists of two representatives from each member society plus the editor and the business manager of the *Illinois Technograph*.

THE ILLINOIS TECHNOGRAPH

One of the foremost engineering student activities is the *Illinois Technograph*, the technical magazine published by the students in the College of Engineering. It began in 1886 as *Selected Papers of the Civil Engineers' Club*, and within a decade had broadened its scope to include all departments. Under its present name it underwent several changes until 1920, when operation was vested in the Illini Publishing Company, a nonprofit corporation organized to publish all of the University of Illinois student periodicals. Three years later it joined the Engineering College Magazines Associated. A quarterly until 1930, it then became a monthly; eight monthly numbers are now published each year.

The magazine has for sixty-five years maintained with a high degree of consistency its policy of printing material prepared by the students,

A corner of the student lounge in the Electrical Engineering building

graduates, and, on occasion, the faculty of the College of Engineering. An integral part of the publication is the material contributed by the Chicago Undergraduate Division (Navy Pier Branch) of the University. This consistent policy has given staff members excellent editorial and business experience and has proved invaluable in encouraging students to prepare technical material for presentation to societies and for later publication.

ENGINEERING OPEN HOUSE

What is now the Engineering Open House began nearly fifty years ago. In its present form it consists of exhibits — most of them serious but some primarily amusing — designed to show visitors the methods and accomplishments of each engineering branch as well as to give them a tour of the College's many buildings and extensive facilities. This two-day activity is organized and conducted by a student committee.

MISCELLANEOUS ACTIVITIES

1. *St. Pat's Ball.* The custom of holding annual engineers' dances was begun in 1910. Those of the 1930's were known as St. Pat's Ball. The event was later discontinued but was started again in 1947 by a group of students who also pointed the way toward the setting up of the present Engineering Council. The Council has since been responsible for sponsoring St. Pat's Ball as one of the outstanding annual social events for engineering students.

2. *Dinners and Smokers.* Although several smokers have been held in the past on a college-wide basis, most are now held as one of the

meetings of the various engineering societies. Many departments also sponsor banquets for the graduating senior class, but in the main the dinner meetings, smokers, and other informal gatherings are sponsored by the professional and honorary societies.

3. *Social Fraternities.* Two fraternities on the campus are composed wholly of engineers. These are Triangle and Sigma Phi Delta.

4. *All-University Activities.* Students of the College of Engineering take part in the great variety of activities — athletic, social, forensic, dramatic, military — open to all University of Illinois undergraduates. Many find the services and functions of the Illini Union particularly rewarding.

This discussion of the activities may have implied that they function under their own power. Of course they do not. Their success depends upon how well you, as a participating student, contribute your share of effort. These activities and others throughout the University will give you innumerable opportunities for reaching the social and civic part of your educational objective. Only by associating with other students and with faculty members connected with these activities can you develop the broad mental outlook and personality you'll need for a successful career and for effective citizenship.

CHICAGO UNDERGRADUATE EXTRACURRICULAR ACTIVITIES

The Chicago Undergraduate Division, like those portions of the University at Champaign-Urbana, recognizes extracurricular activities as an important part of the student's life. Such activities are encouraged as an adjunct to curricular courses, for their value in developing qualities of character, personality, and leadership, and for their aid in developing individual talents in radio production, journalism, speech, music, and other fields.

Student chapters of four of the Founder Engineering Societies are active. These groups are the American Society of Civil Engineers, American Society of Mechanical Engineers, American Institute of Chemical Engineers, and American Institute of Electrical Engineers.

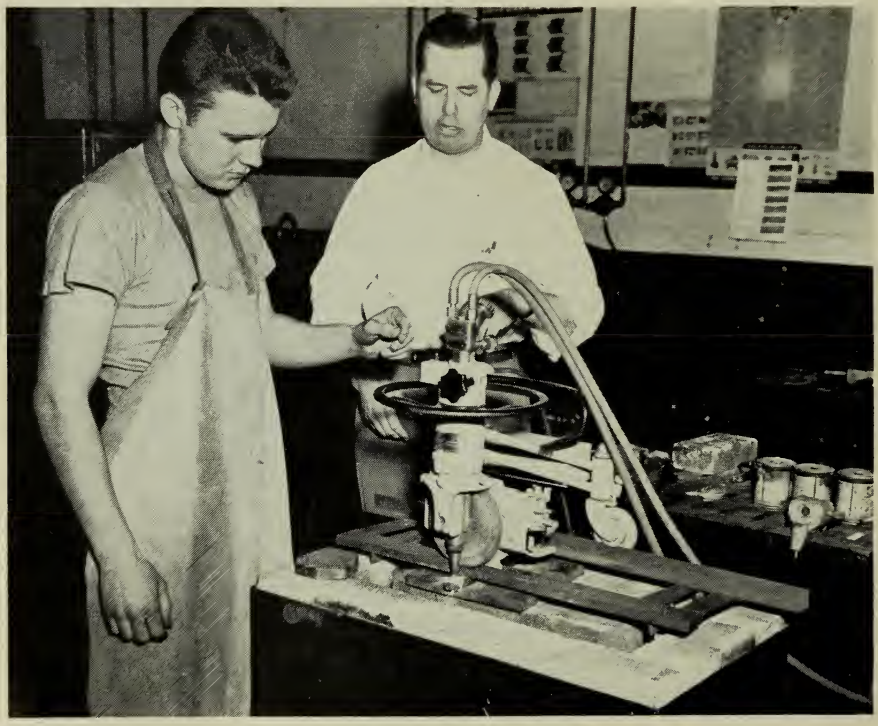
Forty other student clubs and organizations are active at the Pier. They sponsor varied social and cultural activities for the benefit of the entire student body.

Besides a faculty committee on student affairs, there is an active Student Congress. This student self-governing organization is composed of four officers and fourteen representatives elected by the student body. Liaison between the faculty committee and the Congress is provided by seven administrative committees.

The Chicago Undergraduate Division participates in ten varsity sports — football, basketball, baseball, cross-country, track, wrestling, swimming, golf, gymnastics, and tennis. In accordance with a special ruling, freshmen are allowed to participate in varsity sports without violating the three-year eligibility rule. All students, however, must meet Big Ten conference eligibility standards.

An extensive intramural program is carried on. It includes boxing, wrestling, badminton, table tennis, volleyball, basketball, swimming, gymnastics, handball, weight lifting, tennis, track, and softball. Like the intercollegiate program, this is supervised by a subcommittee composed of students and faculty representatives.

Students receive an opportunity for experience in journalism through the weekly student newspaper, the *Pier Illini,* and the yearbook, the *Brave,* both written and edited entirely by students. Engineering students, as mentioned previously, edit the Chicago Undergraduate Division section of the *Illinois Technograph.*



Teaching automatic welder operation in the shop at the Chicago Undergraduate Division

XI. THE ENGINEERING EXPERIMENT STATION

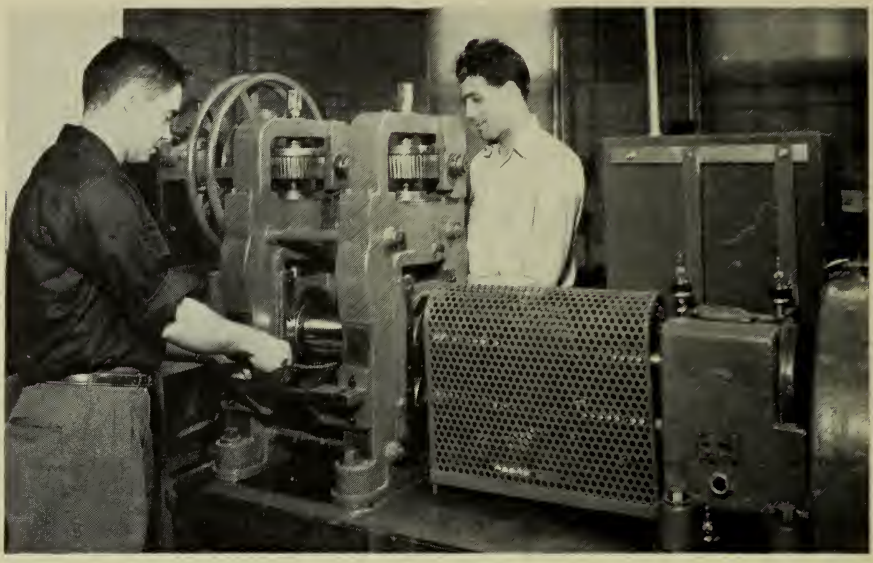
The Illinois Engineering Experiment Station was organized for the purpose of furthering engineering and scientific knowledge through research. The research programs of the Station are conducted by the various departments of the College of Engineering and the division of Chemical Engineering of the Department of Chemistry. Three types of programs are in operation: (1) research sponsored entirely by the University, (2) research conducted in cooperation with government agencies, and (3) research conducted in cooperation with industrial organizations.

Shortly before the turn of the century, several members of the College of Engineering at the University of Illinois realized the growing need for a systematic research program to complement the engineering educational system. It had become time to coordinate the limited research endeavors of the individual departments into a centralized organization designed "to conduct investigations and make studies of importance to the professional engineering and industrial interests of the State."

Professor L. P. Breckenridge, then head of the Mechanical Engineering Department, made attempts to secure Federal aid in establishing engineering experiment stations similar to the agricultural experiment stations. Failing in this purpose, he proposed that such an institution be established at the University with State Funds. As a result, a special request for funds to expand the activities of the Engineering College was made by the Board of Trustees in its legislative appropriations list of December, 1902. In May, 1903, $150,000 was granted by the General Assembly, and on December 8, 1903, the Board of Trustees established the Experiment Station.

Though the first bulletin appeared in September, 1904, the station was not formally organized until June, 1905. At that time, administrative duties were delegated to the Director, who since 1909 has been the Dean of the College of Engineering, and an Executive Staff now composed of the Associate Director, the departmental heads in the College, the professor in charge of Chemical Engineering, and the director of Engineering Information and Publications. This staff is responsible for the general policies correlating and directing the station's research program. In 1951, the increase of the number of projects and expanded scope of administrative duties led to the establishment of the post of Associate Director.

The philosophy governing the policy of the station has been to encourage all members of the faculty to pursue projects of study which are



Rolling mill in Metallurgy laboratory is used by students and for research studies

important to engineering technology and science and which interest them. Since provision has been made for graduate and even undergraduate students to take part in these programs, the teaching and research activities of the college are closely integrated.

The results of research have been published in a series of bulletins and circulars numbering over 540 separate issues. These publications are made available through University and public libraries as well as general distribution. Research results are also presented in conferences and short courses and to the membership of technical societies.

The information gained from these research programs has also been of much value in the classroom training of students, in the introduction and improvement of industrial products for the good of the public and industry, and in the preparedness and efficiency of the defense program.

The research programs offer an opportunity for students to obtain direct training in methods of conducting research. Graduate students are often associated with Station research projects in connection with their master's and Ph.D. thesis problems. Also, graduate and undergraduate students may be connected with these programs for credit in laboratory investigation courses.

The research activities of the Engineering Experiment Station offer income-earning possibilities to qualified students through graduate research assistantships. The Station provides 14 such assistantships for graduate students associated with University-sponsored projects, and

numerous assistantships are available in connection with the governmental and industrial cooperative research programs.

Among the older projects of note are railroad rail studies, boiler water treatment in connection with power boiler equipment, heating research, and "high speed" tool steel studies. The first bulletin published by the station was concerned with Professor A. N. Talbot's studies of reinforced concrete.

In 1954, more than 200 problems were being studied. A number of the newest projects, some of which are grouped together in the Control Systems Laboratory, concern many subjects vital to our present defense program. Among other Station activities are studies of transistors in the Electrical Engineering Department, renewed work on tool steels to resist high temperatures by the mechanical engineers, nuclear and solid state studies by the Physics staff, structural engineering research in the Civil Engineering Department, and tests with radioactive sewage on present-day treatment techniques by the Sanitary Engineering staff.

As the first research organization of its kind to be established within an Engineering College in this country, the Engineering Experiment Station has not only made numerous contributions to the profession and to industry, but has also served as a pattern for the many others which have since been founded elsewhere.

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